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AFRICA TOMORROW:

ISSUES IN TECHNOLOGY, AGRICULTURE, AND U.S. FOREIGN AID

A TECHNICAL MEMORANDUM

DECEMBER 1984

Technical Memoranda are issued by OTA on specific subjects analyzed in recent OTA reports or on projects in process at OTA. They are issued at the request of Members of Congress who are engaged in committee legislative actions which are expected to be resolved before OTA completes its assessment.

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, D. C. 20510

J952-1

Recommended Citation:

Africa Tomorrow: Issues in Technology, Agriculture, and U.S. Foreign Aid—A Technical Memorandum (Washington, DC: U.S. Congress, Office of Technology Assessment, OTA-TM-F-31, December 1984).

Library of Congress Catalog Card Number 85-600503

For sale by the Superintendent of Documents
U.S. Government Printing Office, Washington, D C 20402

Preface

The United States has a stake in the agricultural development of sub-Saharan Africa. Alleviating hunger and malnutrition, expanding stable markets for U.S. products, and maintaining the availability of critical and strategic materials provide humanitarian, economic, and political reasons for a continuing American interest in Africa. Most African countries are predominantly agricultural and their well-being and future development are tied closely to that sector. Therefore, agricultural assistance probably will continue to be a major area of U.S. involvement.

House

Food problems in Africa are substantial: in no other region of the world has per capita food production declined steadily for over two decades. The Congress expressed its concern for these problems in 1984 with a major supplemental appropriations bill and the creation of a Select Committee on Hunger. This technical memorandum on agricultural technology and U.S. foreign assistance in sub-Saharan Africa was requested by the Select Committee, with support from the Africa Subcommittee, House Foreign Affairs Committee. OTA was asked to investigate several topics relating to current and future African agriculture: technological needs, successful technology development and transfer, and the roles of public and private foreign assistance.

This paper is the result of 6 months' work, including: 1) a 2-day workshop with 14 invited experts on African agriculture, 2) a visit by an OTA contractor to the International Institute of Tropical Agriculture in Nigeria, and 3) additional OTA staff research. We do not pretend that this is a definitive work on specific types of agricultural technologies. Instead the paper outlines major issues constraining the development and transfer of sustainable technologies for low-resource food producers. Our findings reflect broad consensus on which potential congressional action can be based. The problems of food production in sub-Saharan Africa are acute. Opportunities for improving the situation abound, however, and many are available to Congress.

This paper was prepared by Scott McCormick, Ted MacDonald, Phyllis Windle, and Chris Elfring, OTA wishes to thank the workshop participants and additional reviewers for their substantial contributions as well as the many others who generously provided information.

John H. Gibbons

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Chapter 1

Summary and Options

Chapter 1

Summary and Options

SUMMARY

Africa's* problems in the immediate future will almost surely worsen. In no other region of the world has food production per capita declined steadily for the last two decades. Population growth is the highest in the world and little expectation exists that this situation will change quickly. Food production simply is not keeping pace with population growth and each year there are more hungry. The current drought has aggravated the suffering and increased stresses on natural resources.

Africa's declining per capita food production has been blamed on many factors: environmental limitations, inadequate incentives for farmers, a lack of appropriate research on food crops, poorly developed extension and management systems, general insensitivity to cultural and environmental conditions, local governments' failures to deliver physical and economic inputs on time, lack of infrastructure, and an inability to identify the problems facing producers. All of these factors, in addition to large population growth, play a part in the problem.

Foreign assistance is one mechanism used by the United States to help solve these problems. The American people traditionally are generous with their public and private assistance. Since foreign aid was first initiated after World War II, the United States has supplied funds, food, and expertise throughout the world, and since 1950 it has directed special attention to developing countries. Foreign assistance programs have grown to reflect our understanding of the humanitarian, economic, political, and security benefits they produce. What is apparent now, however, is that many opportunities exist to improve assistance programs, especially in sub-Saharan Africa, and to encourage constructive activities within the developing nations themselves.

The Role of Foreign Assistance

Foreign assistance has the obvious goal of helping to improve recipients' lives. Agricultural assistance, whether direct food aid or technological assistance to improve food production, aims to alleviate hunger and malnutrition. But in Africa and other parts of the world, the United States also has economic and political rationales for its foreign assistance policies. Foreign aid is a mechanism to promote U.S. interests. Developing countries currently receive 40 percent of all U.S. exports and are the fastest growing market, by value, for U.S. goods and services. Twenty percent of U.S. farm acreage grows crops destined for developing countries. Foreign aid is also used as a nonmilitary tool to further numerous foreign policy objectives such as promoting regional and economic stability, securing access to strategic facilities, and encouraging cooperation with the U.S. on international issues.

Agriculture is the central focus of much American aid to sub-Saharan Africa. The Agency for International Development (AID) allocates about 60 percent of its African assistance to agriculture, or approximately $150 million for fiscal year 1985. Foreign aid can be used to meet short- and long-term goals. Short-term aid, for example, includes emergency food supplies for crises such as the current devastating famines in Ethiopia, Chad, and Mozambique. Such aid serves a critical purpose. Long-term aid is aimed at helping the developing countries become more self-sufficient in food production. For example, such aid includes support for research on improved livestock and crop varieties. Long-term aid includes technology transfer, research, education, and other actions to promote future well-being.

In the face of famine or other crises, long-term agricultural goals are sometimes neglected. But this is extremely short-sighted. Short-term aid alone is not a viable way to improve conditions in Africa. What is needed is a blend of both short- and long-term aid, shaped by long-term goals.

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*Africa, as used in this report, refers to Sub-Saharan Africa (see fig. 1).

Three major weaknesses are seen by many observers to limit the effectiveness of U.S. foreign aid: it is too shortsighted and crisis-oriented, too political, and suffers from unclear and inconsistent goals. Critics argue that American foreign assistance policy erroneously strives for a "quick fix"—development projects are generally too short in duration (3 to 6 years), with limited attention to follow-up. This is particularly disadvantageous to research projects, which generally require longer durations to show results. It will take long-term commitments to make lasting improvements in the difficult agricultural problems faced by sub-Saharan Africa.

Similarly, American foreign assistance sometimes seems preoccupied with new ideas, changing focus from year to year so programs do not have time to chart real progress. Irrigation, education, mechanization, fuelwood, and others have each had a moment in the limelight. The U.S. Government lacks a stable, long-term political commitment to foreign assistance; development policy shifts every decade or so, with mixed results, and public support waivers greatly.

Development assistance policies are shaped more by political considerations than the actual needs of developing countries. Priorities and initiatives shift with administrations as foreign policy goals change, and administration's policies sometimes conflict with legislated goals. This may further some American economic and political objectives but can be detrimental to immediate humanitarian goals and long-term hopes for international cooperation and development.

America's foreign assistance goals not only are unclear they seem at times inconsistent. How, for instance, does the country reconcile its efforts to help developing countries become more self-sufficient in food production when our agricultural sector relies on those nations as essential markets?

Limitations of U.S. Assistance

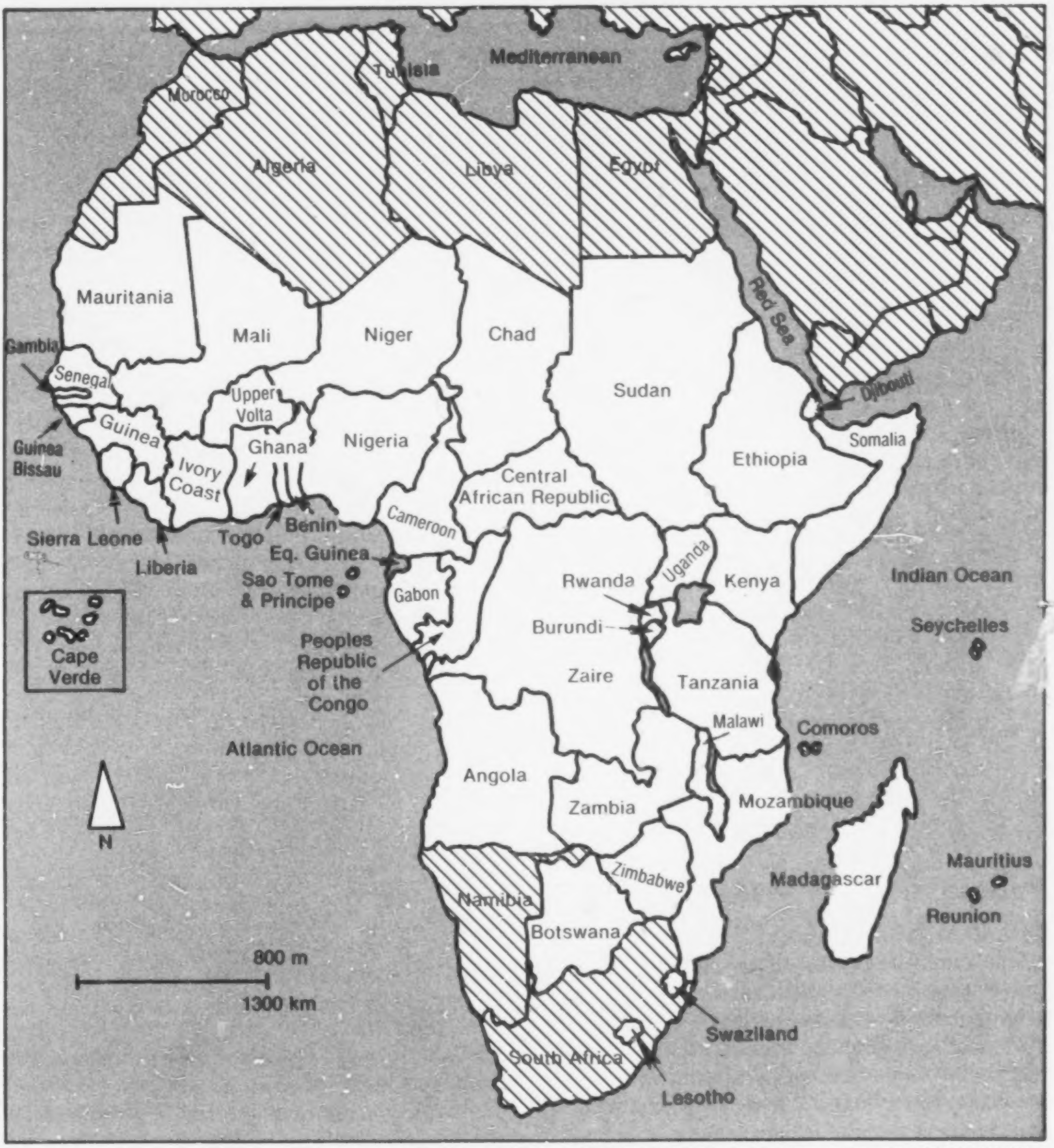
Sub-Saharan Africa is over twice the size of the United States and is made up of 45 different countries (fig. 1). The area contains a wide range of climates and environments and a diversity of cultural, economic, and political characteristics. About 70 percent of Africa's 400 million people live in rural areas. They are predominantly farmers and herders—subsistence level producers who work with few economic and natural resources. Yet these "low resource" farmers and herders provide most of Africa's food. Much of the region is also characterized by the major role women play in food production.

Sometimes foreign assistance donors lose sight of these vast cultural and environmental differences. U.S. assistance, for example, can result in major failures if it is based largely on western traditions: a high-technology, capital-intensive, prof-

Photo credit: U.S. Agency for International Development

Low-resource producers raise the overwhelming majority of food in Africa. These producers are those who face major constraints in their access to economic, natural, and technological resources. Low-resource farmers, such as these from Senegal, generally use hand tools and family labor, till 2 to 10 acres of land, and have little capital.

Figure 1.—Sub-Saharan Africa



SOURCE: General Accounting Office, "Africa's Agricultural Policies: A More Concerted Effort Will Be Needed If Reform Is Expected," GAO/NSIAD-83-36, Sept. 8, 1983. (Adapted from map by Martin Greenwald Associates, Inc.)

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it-maximizing orientation. A consensus is emerging that the technology most needed in sub-Saharan Africa should be:

- low-risk,
- resource-conserving,
- small-scale,
- affordable (not capital intensive),
- locally produced and repaired,
- adapted to local labor availability, and
- consistent with traditional agricultural methods.

In essence, technologies* must be appropriate for the local setting. To be appropriate, the natural limitations of the African environment must be considered in the design of the technology. To be appropriate, livestock, cropping, and forestry technologies must be integrated with each other and with nonagricultural sectors. In addition, local producers need increased involvement in the agricultural development process. Foreign assistance agencies need to solicit the input of local producers when identifying agricultural problems, planning, and implementing projects or research. Local people have an intimate knowledge of their needs and environment, and they are likely to be more receptive to projects that are partly their own. The challenge, then, is to devise systems that involve local people and that integrate on-farm work into the larger framework of established national programs and international assistance.

The Recipients of Foreign Assistance

It seems an easy question: "Who needs assistance?" But identifying, let alone reaching, appropriate recipients can be difficult, especially if the objectives of the aid are unclear. If America's overall goal is to help Africa increase food production, assistance needs to be focused on low-resource producers because they are the backbone of Africa's food system. If America's goal is meeting the basic needs of the poorest, assistance should take a different bent because the poorest people include not only farmers but also landless and urban populations.

In the past, assistance strategies largely have neglected the important role played by women in African agriculture. Women in Africa contribute up to 80 percent of all farm labor, they manage one-third of the region's farms, and they tend virtually all the kitchen gardens. Yet, directly and indirectly, women are excluded from community meetings, extension services, and access to credit. Few women have entered the ranks of agricultural professionals working for donor agencies or developing country ministries.

Directing special attention toward women may seem to be one solution to this problem. Disregarding the crucial role of African women in agriculture is unwise, yet specifically aiming projects at women's needs also may be inappropriate. A more realistic approach is to recognize that women need to be integrated into development planning as partners. Extension services, in particular, need improvement in this area. To date, the track record for attempts to integrate women into agricultural assistance programs has been poor.

Targeting any specific group—e.g., the poorest—can be difficult. First, can the group be defined explicitly—who are they—and how can they be reached effectively through donor assistance? Is key information about the group available? Does the group remain constant from year to year? How can sustainable, replicable programs be designed that will reach that group? Realistic approaches account for the special constraints certain groups face and ensure that these groups are included in development assistance.

The Responsibility of African Governments

The primary responsibility for improving food production in sub-Saharan Africa lies with the African governments themselves. Foreign assistance is just that—assistance. But in most of Africa, a variety of obstacles inhibit the design and management of sound national agricultural strategies. Some government institutions face unmanageable tasks trying to coordinate large numbers of donors. When levels of support are erratic, the problem is compounded and host countries have few incentives to plan comprehensive programs to meet their actual needs.

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*Technologies include implements, management systems, and other processes for applying knowledge.

Despite limitations, African governments have significant opportunities to improve food production. One way is to increase incentives for rural producers. Another task is to provide more adequate reward and support for government extension workers in rural areas. They can also encourage integration of women producers into agricultural planning. In all, what is needed is a more active and long-term commitment to food production. But it must be remembered that food production is only one part of the agricultural sector and that agriculture is only one part of an overall development strategy. While changes must be made by African governments, donors will have a special responsibility to provide appropriate support.

Africa Tomorrow

Despite the magnitude of its problems, Africa has reasons for optimism. Ten years ago, India faced a similar plight and many feared that the enormity of the problems could not be overcome. Yet today India feeds itself. Africa's problems, of course, are unique and require unique solutions. But evidence exists that Africans and donors are beginning to address key questions and find some answers. Since the problems are severe and complex, their solution will require greater commitment than now exists.

The United States can continue to play an important role in improving food production and alleviating hunger and malnutrition in sub-Saharan Africa. The best hope of increasing food production lies with improving opportunities for the low-resource producers—they provide an overwhelming proportion of the region's food supplies and yet they have been largely ignored. The United States can contribute appropriate assistance with agricultural education, research, and technologies.

Today, Africa is a continent in trouble. The United States could make certain choices that increase the likelihood that Africa's future will be a hungry one—facing the possibility of social and environmental problems of global dimensions. Or the United States could strengthen its leadership in foreign assistance, examining the part that this country can play in alleviating Africa's dilemma and coordinating with other nations to help Africa reach a future chosen by its people.

> For some substantial number of the world's poor, the United States still holds out the future to which they aspire. What they require from us is not advice . . . but action alongside them in the task of hastening their economic development. Belonging to the same world population, we have as large a stake in the outcome as they do.
>
> —Gerard Piel, 1984 President-elect, AAAS
> Chairman of the Board, *Scientific American*

OPTIONS

On the Right Track

In recent years, Congress has taken a number of actions that have confirmed America's commitment to increasing Africa's food production in equitable and sustainable ways. Legislation has resulted in initiatives that address many of the findings of this report. OTA finds that each of the initiatives remains relevant and important. Their direction is, for the most part, consistent with recent information on technology and food production in Africa.

This section reviews some of this report's major conclusions and the existing legislation that OTA feels is both relevant and appropriate to resolving some of the problems presented. Unless otherwise noted, the provisions cited refer to the Foreign Assistance Act of 1961, as amended (U.S. Congress, Feb. 1984).

- *Emphasis should be placed on low-resource producers:* The Congress finds that the greatest potential for significantly expanding food production lies in increasing the productivity of small farmers who constitute a majority of agricultural producers in developing countries [sec. 103(c)].
- *Greater emphasis is needed on research for low-resource producers:* Agricultural research shall: 1) consider the special needs of small

farmers; 2) include research on the interrelationships among technology, institutions, and economic, social, environmental, and cultural factors affecting small-farm agriculture; and 3) make extensive use of field testing to adapt basic research to local conditions [sec. 103A].

- *Technologies should account for the particular needs and constraints of the low-resource producer:* Emphasis shall be placed on use of relatively smaller, cost-saving, labor-using technologies most appropriate for small farms, small businesses, and small incomes of the poor [sec. 107].
- *Greater emphasis is needed on the role of women in development:* U.S. assistance should promote the participation of women in national economies of developing countries and the improvement of women's status as an important means of promoting the total development effort [sec. 102(b)(6) and sec. 113(a) c.f.].
- The Congress declares that the principal purpose of U.S. bilateral development assistance is to help the poor majority of people in developing countries to participate in a process of equitable growth through productive work and to influence decisions that shape their lives, with the goal of increasing their incomes and their access to public services which will enable them to satisfy their basic needs and lead lives of decency, dignity, and hope [sec. 102].
- *Assistance efforts are more efficient and effective if donors coordinate:* U.S. assistance efforts shall be planned in coordination and cooperation with assistance efforts of other countries, including the planning and implementation of programs and projects on a multilateral and multidonor basis [sec. 102(b)(11)].
- *More effective evaluation is needed for projects and programs undertaken by AID:* The International Development Cooperation Agency (IDCA) is directed to improve the assessment and evaluation of the programs and projects carried out [sec. 125].
- *Private and voluntary organizations have a major role to play in assisting the poor in meeting their basic needs and in increasing public awareness of hunger and poverty in developing countries:* Congress finds that development can be assisted and accelerated through an increase in activities planned and carried out by private and voluntary organizations and cooperatives. Their financial resources should be supplemented by contributions of public funds without compromising their private and independent nature [sec. 123].

  To increase public awareness of the political, economic, technical, and social factors relating to hunger and poverty and to ensure the effectiveness of private and voluntary organizations in dealing with world hunger abroad, AID is urged to assist private and voluntary organizations [International Security and Development Cooperation Act of 1980, Title III, sec. 316].
- *To help increase food production in Africa, the Federal Government should support and encourage appropriate research by U.S. universities, national and regional research facilities in Africa, and international agricultural research centers:* This support should be provided on a long-term and continuing basis. The United States should improve U.S. land grant and other eligible universities' participation in international efforts to apply more effective agricultural sciences to the goal of increasing world food production, and should provide increased and longer term support to the application of science to solving food and nutrition problems of the developing countries [sec. 296(a)].

  To prevent famine and establish freedom from hunger, various components must be brought together in order to increase food production including:

  1. strengthening the capabilities of universities to assist in increasing agricultural production in developing countries,
  2. institution-building programs for development of national and regional agricultural research and extension capacities in developing countries that need assistance,
  3. international agricultural research centers [sec. 296(b)].
- *Development is primarily the responsibility of African governments:* Development plan-

ning must be the responsibility of each sovereign country. U.S. assistance should be administered in a collaborative style to support the development goals chosen by each country receiving assistance [sec. 102(b)(2)].

- *Further efforts to prevent degradation of natural resources are vital to sustained agricultural development:* The President is authorized to furnish assistance for developing and strengthening the capacity of developing countries to protect and manage their environment and natural resources. Special efforts shall be made to maintain and restore the land, vegetation, water, wildlife, and other resources upon which depend economic growth and human well being, especially of the poor [sec. 118(b)].

While this legislation is consistent with the findings of this report and suggests that the United States has taken steps in the right direction, Congress has a continuing role to play in monitoring the progress of these efforts and correcting any unexpected adverse effects of its original legislation or amendments. OTA's preliminary analysis suggests that Congress could continue to encourage the executive branch to demonstrate that specific legislative instructions are being carried out. Requests for reports from the executive branch and holding congressional hearings are two methods for doing this.

New Initiatives

Another way the Congress could enhance the effectiveness of U.S. assistance to Africa is by undertaking certain new initiatives. OTA finds that important changes in the U.S. approach could substantially improve food production.

A Commitment Measured in Decades

Finding: U.S. assistance needs to be long-term and consistent over time if the United States is committed to increasing food production in Africa. Currently, the United States supports hundreds of short-term projects designed to encourage long-term development. The goals and objectives of these activities are often unclear and inconsistent and their effectiveness is hampered by political considerations.

Many experts are coming to agree that long-term improvements in food production require commitments—for projects and agricultural research—of at least 10 to 20 years. AID-sponsored projects seldom last this long, although AID contends that the trend in project length is upward. Most programs face annual scrutiny, and political and fiscal considerations determine their continuation. While monitoring project effectiveness is appropriate, certain types of projects, particularly research efforts, are not likely to show immediate results and will require long-term continued support.

The inclusion of political factors in designating recipients of U.S. assistance is always controversial. Evidence exists that frequent shifts in both development approaches and countries designated as acceptable recipients reduce the effectiveness of U.S. assistance. Much U.S. assistance is channeled through private and voluntary organizations. Some of these groups, especially those with long-term programs in Africa, are particularly affected by U.S. policy changes.

In addition, the United States sponsors some programs that have seemingly conflicting goals—e.g., attempts to increase local food production while simultaneously providing aid to dispose of U.S. agricultural surpluses or expand markets for U.S. food products. The Food for Peace Program (Public Law 480) is often cited as an example of America's unclear and conflicting foreign assistance goals.

These factors—the short-term, political, and unclear nature of U.S. foreign aid—are major limits to its effectiveness. Congress could begin to resolve these issues by several means.

Option: Congress could examine the soundness of AID's major operational method—the design and support of individual local projects—as a means of providing long-term, well coordinated assistance. Alternatives that might provide less fragmentary aid with fewer administrative burdens could be examined—e.g., supplying funds in lump sums for large program areas such as institutional development, training, and university post-graduate program development. The need for such "program" assistance in reseach funding could be evaluated in detail. Other alternatives might include adopting the most effective provisions used by other bilateral donors or integrating all types of aid into individual country programs.

Option: Congress could reemphasize its commitment to coordination among public and private donors by exploring new ways to encourage this coordination, such as: a) hear testimony from donors on their needs, b) investigate the need to bring additional donors into existing donor coordination groups, and c) explore other means to strengthen coalitions of public and private donors.

Option: Congress could evaluate whether AID's cooperation with private and voluntary organizations is meeting the congressional intent in Section 123 of the Foreign Assistance Act. This evaluation could include: thoroughly examining the effectiveness of these organizations' work versus government funding; clarifying whether Congress intended that their programs be confined to certain countries designated by AID as acceptable recipients of U.S. assistance; and assessing whether AID should model the scale of its programs after some private and voluntary organizations' small-scale efforts, which many experts regard as a particularly effective approach.

Option: Congress could require that AID increase the average duration of individual assistance projects/programs designed to increase long-term development of African food production. For example, Congress could stipulate that the average length of such projects should increase to 10 to 15 years by a given target date.

Option: Congress could request that the General Accounting Office (GAO) conduct a major evaluation of Public Law 480's effects on African food production and synthesize its considerable body of past Public Law 480 work. Such a study would capitalize on GAO's a) ability to conduct local investigations in Africa, b) expertise in accounting, and c) extensive record of Public Law 480 analysis. Important issues include the alleged displacement of local farmers and technologies, shifts in diet, and disincentives for local food production.

Reaching Those Most in Need

Finding: The possibility of successfully directing agricultural assistance to meet the needs of specific target groups remains debatable.

The Foreign Assistance Act, section 128, requires that 40 percent of AID's funding be directed toward the poorest residents. And the spirit of this legislation is important in ensuring that AID meets its responsibilities to assist the poorest people of Africa.

However, many questions have arisen regarding the best method to accomplish this goal, AID's relative success in meeting it, and whether agricultural assistance is the most effective way to meet the poorest people's needs. Some of the poorest people may be those with little or no access to land or livestock, female heads of households, the chronically underemployed in urban areas, or refugees. Projects designed to stimulate employment and other income-generating activities or to meet basic needs may be more appropriate uses of funds for assisting these poor. At the same time, aid to increase food production could be directed toward alleviating the constraints of low-resource producers, who are usually poor themselves but maybe not the "poorest."

Reliable data on the heterogeneous group called "the poor" are scarce. Therefore, much remains to be done to understand the poor who face severe economic, social, technical, or environmental constraints on their attempts to increase food production. More information is needed on the types, proportions, and magnitude of their problems as well as the constraints faced by other poor people such as the landless and unemployed.

Congress could assist in this effort by determining the beneficiaries of agricultural versus income-generating projects and examining the need for special attention to low-resource producers.

Option: Congress could reiterate its commitment to Section 128 of the Foreign Assistance Act by holding hearings to determine strategies and funding levels necessary to meet the needs of the poorest rural residents. Witnesses could include representatives from: a) African governments at the national and regional levels—e.g., national ministers of health, water resources, agriculture, and women's affairs, and representatives of the Organization of African Unity; b) international food agencies such as the United Nations' Food and Agriculture Organization (FAO); c) private and voluntary organizations with expertise in rural land reform and community development; and d) the U.S. Agency for International Development.

Option: Congress could consider new legislation and funding that would be specifically aimed at reducing constraints which inhibit the majority of low-resource producers from increasing food production.

Option: Congress could require AID to provide information on: a) how the Agency could increase its effectiveness in evaluating its own programs and incorporate this information into future project design and implementation, and b) the level of funding necessary to fulfill this task. Congress could also help make evaluation a project design tool by encouraging AID to: establish an evaluation staff officer for each mission and regional AID office; collect improved baseline demographic data in host countries—e.g., data disaggregated by sex and economic class; and include the proposed beneficiaries (especially women and low-resource producers) in the design and evaluation phases of project development.

Option: Congress could investigate the relative merits of the "grass roots" development strategy represented by the African Development Foundation (ADF). Congress could support the ADF by: carrying over the Foundation's unallocated fiscal year 1984 funds into 1985, funding ADF past fiscal year 1986, supporting ADF's forums on "grass roots" development, and strengthening the organization's management and technical capacity.

Women: The Invisible Producers

Finding: Women contribute significantly to the production of food crops but have limited access to extension services, credit, and training.

Women contribute up to four-fifths of the labor and management for the production of food crops in Africa. They receive few services to help them increase food production despite the fact that their important role has been recognized internationally for over 10 years. Women represent some of the most overworked and undersupported and, in most cases, some of the poorest of the rural population. Therefore, providing assistance to women farmers and herders is crucial to increasing African food production.

Many ways exist that African women producers can be assisted by donors such as the United States and by African governments. Primarily, women need greater access to extension services, affordable credit, reliable land rights, and training in food production technologies that are generally more available to men. Women development experts and agricultural professionals will be better able to provide these services in many countries due to cultural constraints. Congress could assist African food producers by helping to make more women agricultural experts available.

Option: Congress could direct AID to give priority to hiring women agricultural professionals as project officers. Over the last several years, AID appears to be recruiting more female International Development Interns. Increased emphasis could be placed on increasing women staff in AID Africa missions, given the importance of women in agricultural development in Africa. It is also important that the women recruited have training in agriculture and environmental science as well as health, nutrition, and social science.

Option: Congress could direct AID to expand the selection of African women for overseas training courses. Over the past 7 years, only 16 to 18 percent of all the African participants were women. Congress could consider imposing standards on AID for the selection of more women so that equal numbers of men and women are trained.

Option: Congress could direct AID to upgrade the Women in Development (WID) position in its African missions to ensure that the WID officer is involved in all phases of project identification, development, implementation, and evaluation and that WID officers are people with technical expertise and developing-country field experience. Congress could request periodic reports on AID progress on these activities as well as AID's progress in implementing its Women in Development Policy Paper.

Option: Congress could direct AID to encourage host countries to recruit additional female agricultural extension staff. Also, Congress could request that AID develop training courses for African male and female extension agents that would provide methods for them to reach women food producers.

Technology Types: The Right Stuff

Finding: Farmers and herders with little access to economic and natural resources hold the key to increasing food production in Africa. Technologies to help these low-resource producers are largely lacking, especially in developed countries such as the United States.

A consensus exists that low-resource producers are the group most likely to increase food production enough to feed a significantly greater number of Africa's population. A consensus also exists regarding the types of technologies these producers need: low risk, resource-conserving, small-scale, adapted to local labor conditions, consistent with traditional agricultural methods, affordable, and locally produced and repaired. Some of these technologies can be adapted from current traditional practices. A need also exists for new types of technologies, especially given the large projected increases in total and urban African populations.

U.S. agricultural technologies—both equipment and management systems—generally do not exhibit the characteristics most needed by low-resource producers. Therefore, many attempts to use U.S. agricultural technology directly in African food production have been unsuccessful. Many feel that America's considerable agricultural expertise has much to offer Africans, but care will need to be taken if it is to be brought to bear effectively.

The Congress directed that special attention be given to "appropriate technology" in section 107 of the Foreign Assistance Act. OTA finds that such attention is justified and that methods could be devised to make relevant information developed in the United States more available to African researchers and producers.

Option: Congress could reaffirm its commitment to section 107 of the Foreign Assistance Act by holding hearings on AID's implementation of this legislation and the institution created to do so (ATI—Appropriate Technology International). These hearings could consider whether section 107 should be amended to alter its language calling for "labor-using" technology. Recent recognition exists that low-resource producers face periodic labor shortages; thus sometimes "labor-using" technology can be inappropriate to their needs.

Option: Congress could design a program to link U.S. experts in technology for low-resource producers to the U.S. Department of Agriculture's (USDA) international training activities in order to increase their relevance to African conditions. This would require that USDA involve non-USDA staff such as returned Peace Corps volunteers, field representatives of private and voluntary organizations, and researchers in "alternative" agriculture.

A Worldwide Network for Agricultural Research

Finding: The United States is in a unique position to encourage strong national and international agricultural research facilities in Africa. The inclusion of farmers and herders in this work, as well as the widespread dissemination of its results, is vital to making research effective.

The United States has played a major role in supporting agricultural research in Africa, both via the international agricultural research centers and via programs coordinated by U.S. universities. The United States supplies approximately 20 percent of the core budget for the Consultative Group on International Agricultural Research (CGIAR), which sponsors the international centers, and also supports staff and students. Some universities have a long history of international activity but their programs have shifted according to changing African and American views of the most appropriate U.S. assistance.

Congress is involved directly in determining how U.S. scientists take part in African research. Many U.S. university programs, for example, were instigated after Title XII of the Foreign Assistance Act made special AID programs available to them. Experts suggest that past approaches to support African research need to be supplemented with new programs. These should give increased attention to developing national research centers in Africa and providing additional training for African agricultural scientists at home, rather than in the United States. Such efforts would benefit agricultural research while building local institutions and management capacity, another vital African need.

A consensus exists that alleviating two key problems could increase the effectiveness of agricultural research. First, low-resource producers need to be incorporated into the process of designing, planning, and evaluating research. And, second, research results should be disseminated widely and effectively.

Option: Congress could direct increased resources into national research centers and universities in Africa by: helping to develop expanded African graduate programs in food production; encouraging U.S. universities to increase cooperative programs with national universities; providing funds for USDA and State Agricultural Experiment Stations to work with African national centers on problems of common interest—e.g., sorghum breeding or dairy production; making American researchers available to help African countries develop agricultural training programs for Africans in Africa or other appropriate developing countries.

Option: Congress could establish a way for U.S. technology to be used to disseminate agricultural information in Africa. This might include: increasing the availability and interpretation of satellite imagery on natural resources for African governments; encouraging microcomputer manufacturers to provide agricultural services that are suitable for African conditions; ensuring that all U.S. support for international, regional, and national research centers provides adequate funds for international travel, documentation and distribution of findings, and purchase of relevant publications.

Option: Congress could highlight the current and potential benefits, both to Africa and the United States, of farmer/researcher cooperation by holding hearings on farming systems research as it is conducted in the United States and in Africa.

Agricultural Extension Services: Delivering the Goods

Finding: Agricultural extension systems in Africa generally are ineffective at either identifying food producers' constraints or disseminating information on technology, credit, or inputs.

Despite having formal extension systems in place, most African countries' extension services generally are ineffective in transferring information and inputs. Most: a) lack clear goals and objectives; b) provide little support for or few incentives to staff working with low-resource producers, especially women; c) coordinate poorly with research institutes in identifying the major constraints of low-resource producers; and d) may promote technologies that primarily benefit the wealthy rural producers.

Numerous attempts have been made to provide alternative extension models, improve infrastructure and supervision for staff, and increase the frequency of in-service training courses. Congress has provided support for development of African extension systems by both AID and USDA. Congress could act to strengthen existing African systems further.

Option: Congress could investigate the problems facing African extension systems and the most effective U.S. role to meet the needs of low-resource producers in increasing food production. This could include input from AID, USDA, the World Bank, and others.

Option: Congress could direct AID to identify extension problems unique to each country. AID mission staff could interview agriculture officials and local university staff and hold workshops to solicit the views of local leaders and low-resource producers.

The Pressure for Reform

Finding: African governments, though facing increasing external pressure for

change, generally support economic policies that favor urban consumers at the expense of incentives for low-resource food producers.

During the last two decades, African governments generally have opted for economic policies that favor urban consumers. Prices paid to producers for food crops have been artificially low, while inflated currencies and increased international borrowing allowed relatively inexpensive food and consumer goods to be imported.

Now, African governments face several conflicting forces that threaten their economic independence. The International Monetary Fund (IMF) and the World Bank are increasing the restrictions on foreign assistance and rescheduling loans. Many governments find it difficult to fulfill these strict conditions while simultaneously pursuing their own national priorities.

Option: Congress could assist African governments, via U.S participation in policymaking at the IMF and the World Bank, by encouraging greater cooperation between these organizations and African governments. Congress could examine the feasibility and desirability of monetary policies advocated by African countries such as more gradual currency devaluation, longer loan repayment periods, and appropriate conditions for further loans.

Option: Congress could require that AID report on uses of the Economic Support Fund (ESF) to alleviate international debts in African developing nations, including the role of the ESF to absorb the effects of rapid increases in the price of food and consumer goods in urban areas.

The Resource Base: Keeping Renewable Resources Renewable

Finding: African governments and international donors exhibit a limited commitment to controlling the degradation of Africa's natural resource base.

Deforestation, loss of soil fertility, and other types of land degradation are major problems in Africa. They are caused by increasing pressure on a finite natural resource base and unsustainable agricultural development.

Sustainable food production requires the integration of sound environmental policies into agricultural programs. Experts in developing countries note the continuing need for increased amounts of information on the environmental impacts of technologies that are part of U.S. development projects. Congress could assist this process in several ways.

Option: Congress could require that AID report on efforts agencywide and within the Africa Bureau in particular to fulfill the requirements of section 118 (c)(1) of the Foreign Assistance Act that the environmental consequences of development projects and programs be considered.

Option: Congress could investigate the status of AID's environmental profiles for African countries and mandate that the profiles be integrated into the agricultural develpment strategies.

Option: Congress could provide funds for a significant increase in the number of appropriately trained environmental field officers for AID field missions and regional offices.

Chapter 2

Introduction

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In November 1974 the World Food Conference was convened to address grave concerns over the future world supply of food. The conference declared that:

> [A]ll governments should accept the removal of the scourge of hunger and malnutrition . . . as the objective of the international community as a whole, and accept the goal that within a decade no child will go to bed hungry, that no family will fear for its next day's bread, and that no human being's future and capacities will be stunted by malnutrition (U.S. Congress, Oct. 1984).

A decade has passed since this declaration was made but much of Africa is once again facing a famine of enormous proportions. The United Nations' Food and Agriculture Organization (FAO) estimates that during the past year 150 million people were living in countries that suffered severe food shortages as a consequence of the drought (Levy, 1984). Catholic Relief Services (CRS), the private organization with major responsibility for distributing emergency food aid in Ethiopia (the country hardest hit by the drought), estimates that in that country alone, 6 million to 10 million people are facing starvation. This crisis has prompted massive emergency food assistance from numerous donors, including the United States. While these deliveries are essential to avoid massive starvation, the long-term resolution of African food problems must entail efforts to increase Africa's ability to feed itself.

It is this goal of increased food production in Africa that this report addresses. In particular, this report examines what technologies are needed and how they may best be made available. The report defines various issues in technology development, technology transfer, and technical assistance that could be considered by the U.S. Congress in forging an effective strategy to assist African countries to enhance their food production. The report also addresses problems African governments face in increasing food production, given that the responsibility for achieving this goal lies primarily with them.

FOOD PROBLEMS IN SUB-SAHARAN AFRICA

Sub-Saharan Africa is facing its second severe food crisis in a little over a decade. Chronic food deficits have reached a point where, according to the U.S. Department of Agriculture (USDA), nearly 5 million tons of food aid will be required during 1984-85 just to maintain current per capita consumption levels. Some 10 million tons would be required to reach minimum acceptable nutritional levels, according to dietary standards established by the World Health Organization (WHO) and FAO. These figures represent 40 percent of the requirements for all developing regions of North Africa, the Middle East, Asia, and Latin America (USDA, July 1984b).

In examining the total food aid needs of all developing countries, a recent report suggested that:

> In 1984-85, it is estimated that total food aid in cereal from OECD donor countries will be approximately 9 million tons. Of this total, the United States will contribute approximately 5 million tons. When compared to the 12 million tons needed to sustain current consumption levels and higher quantities to improve diets, it appears that donor countries must greatly increase the quantity of food assistance in the short term and heighten efforts to assist developing countries improve their own agricultural production in the long term (Andreas Task Force, 1984).

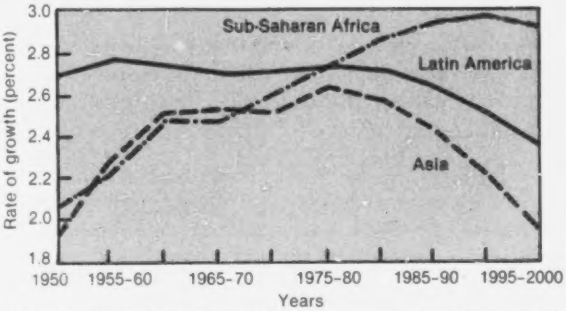
The current African drought, which began in the southern region in 1981 and spread through the Sahel in 1982, continues to have a major impact on crops and livestock in many countries. About 30 countries are suffering from abnormal food shortages according to recent FAO figures. The FAO World Food Program Task Force identified 10 sub-Saharan African countries as "crisis countries for the 1984-85 crop year" and others may be added to the list (U.N. FAO, Sept. 1984).

While the drought has focused international attention on the region, its effects represent only "the most extreme and distressing aspects of the more pervasive economic crisis in Africa" (World Bank, 1984a). The prevailing conditions simply highlight the long-term unfavorable trends that have been developing in Africa for the last two decades.

A unique combination of constraints characterizes this region and helps to explain, in part, why the "Green Revolution," which dramatically raised food production in other developing regions has, to date, bypassed sub-Saharan Africa.

- Sub-Saharan Africa is the only region of the world where the rate of population growth will continue to rise during the 1980s (fig. 2; table 1). The 1980 population of 359 million probably will double by the turn of the century and more than triple by 2020 (World Bank, 1984a).
- Generally speaking, the region suffers from considerable political instability. One in 200 Africans is a refugee. With only one-tenth of the world's population, Africa contains at least one-quarter of the world's refugees (World Bank, 1984a).

Figure 2.—Sub-Saharan Africa, Asia, and Latin America Population Growth Rates, 1950-2000



SOURCE: U.N. Population Trends and Policies, vol. 1, *In:* U.S. Department of Agriculture, "Food Problems and Prospects in Sub-Saharan Africa," *Development Digest*, vol. XIX, No. 4, Oct. 1981.

- Low and erratic rainfall, short growing seasons, low soil productivity, and continuing soil degradation and deforestation due to human activities make raising agricultural productivity in many parts of sub-Saharan Africa more difficult than in most developing regions. Much of the potential grazing

Table 1.—Population Growth Rates in Sub-Saharan Africa

Region and country	1970-75	1985-90
	Percent	
The Sahel:		
Chad	2.00	2.16
Gambia	1.92	2.13
Mali	2.42	2.74
Mauritania	1.99	2.35
Niger	2.68	2.97
Senegal	2.37	2.55
Upper Volta	2.27	2.49
West Africa:		
Benin	2.70	2.80
Cameroon	1.84	2.45
Ghana	2.70	3.19
Guinea	2.38	2.68
Guinea-Bissau	1.51	1.94
Ivory Coast	2.51	2.79
Liberia	2.29	2.57
Nigeria	2.67	3.09
Sierra Leone	2.41	2.65
Togo	2.74	2.49
Central Africa:		
Angola	2.27	2.73
Central African Republic	2.09	2.59
Congo	2.44	2.84
Equatorial Guinea	1.71	1.96
Gabon	1.00	.90
Zaire	2.47	2.85
East Africa:		
Burundi	2.60	2.72
Ethiopia	2.39	2.60
Kenya	3.38	3.45
Rwanda	3.04	3.14
Somalia	2.65	3.00
Sudan	2.56	2.94
Tanzania	3.02	3.20
Uganda	2.93	3.09
Southern Africa:		
Botswana	2.27	2.99
Lesotho	1.92	2.32
Malawi	2.52	2.74
Mozambique	2.32	2.64
Namibia	2.84	3.07
Swaziland	2.73	2.92
Zambia	3.13	3.38
Zimbabwe	3.35	3.60
Madagascar	2.42	2.79

SOURCE: United Nations, *World Population Trends and Policies 1977 Monitoring Report*, In: U.S. Department of Agriculture, *Food Problems and Prospects in Sub-Saharan Africa*, Foreign Agricultural Research Report No. 166, August 1981, p. 38.

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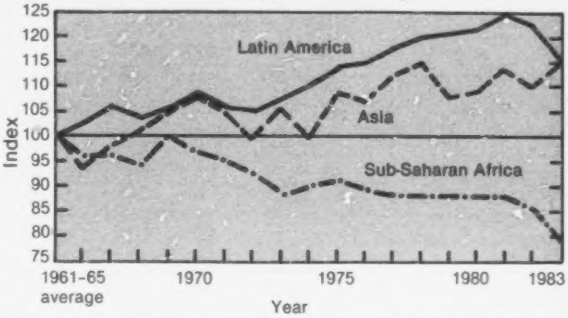
land is unusable because of tsetse fly infestation.

- The colonial legacy in Africa left fewer trained people and institutions than in other developing regions. Despite impressive gains in levels of education since independence, sub-Saharan Africa still has proportionately fewer skilled people than other developing regions. African countries in general also have poorly developed infrastructures.
- Government policies in most African countries have adversely affected food production, including: an urban bias in development strategies, a lack of attention to low-resource farmers (the base of the food production system), a lack of price incentives for farmers to grow food crops, often inappropriate and inefficient government involvement in the marketing and distribution of agricultural inputs and outputs, and often inappropriate import and fiscal policies (U.S. AID, 1983; World Bank, 1981).
- Projects directed at increasing agricultural production by donors and African governments have often been poorly conceived and managed. In some cases the result has been a worsening of the situation because of major damages to the resource base.

This combination of demographic pressures, environmental constraints, political impediments, limited trained personnel, and inadequate institutional and management capacity has resulted in a variety of symptoms that currently plague the region and threaten to worsen in the future:

- Africa's population growth rate, about 3 percent per year, is outpacing growth in food production, which is about 1.8 percent per year (World Bank, 1984a; USDA, 1981). The result has been a steady decline in per capita food production over the last two decades (fig. 3; table 2).
- Consequently, Africa, which was essentially self-sufficient in food production 20 years ago, now imports 20 percent of its cereal requirements. Between 1970 and 1980 cereal imports tripled while the cost of those imports increased 600 percent, further straining limited financial resources (Christensen and Witucki, 1982; Huddleston, 1984).

Figure 3.—Index of Per Capita Food Production, 1961-65 to 1983 (1961-65 Average = 100)



SOURCE: U.S. Department of Agriculture, In: World Bank, *Toward Sustained Development in Sub-Saharan Africa*, 1984.

- Sub-Saharan Africa is the only developing region in the world where levels of nutrition have declined in recent years. Despite major increases in food imports and food aid, it is estimated that 20 percent of the population of Africa consumes below-minimum caloric levels for maintaining good health (World Bank, 1984a).
- The rate of urban growth, at 5 to 7 percent per year (a 7 percent growth rate results in a doubling of population in about 10 years), is the highest in the world, although the level of urbanization in sub-Saharan Africa is relatively low compared with other developing regions. Immigrants to Africa's cities often come from impoverished rural areas and their movements add to the destabilizing effects of rapid urbanization.
- The region has shown a declining per capita Gross Domestic Product (GDP) accompanied by fiscal and balance-of-payment problems, oppressive debt burdens, dwindling reserves of foreign exchange, and deteriorating terms of trade (World Bank, 1983).

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Table 2.—Food and Agriculture in Selected Countries

	Volume of food imports (000 metric tons)		Food aid in cereals (000 metric tons)		Average index of food production per capita, 1979-81
	1974	1981	1970	1980	1969 – 1971 = 100
Angola	149	244	0	25	81
Benin	8	93	9	11	96
Burundi	7	19	6	12	100
Cameroon	81	106	4	9	101
CAR	7	14	1	3	102
Chad	50	14	13	14	106
Congo	34	56	2	2	82
Ethiopia	118	207	59	228	85
Ghana	177	256	43	94	74
Guinea	63	134	49	34	87
Ivory Coast	172	619	4	0	110
Kenya	15	534	2	173	85
Lesotho	49	95	14	44	86
Liberia	42	111	3	26	95
Madagascar	114	268	7	26	94
Malawi	17	113	—	17	96
Mali	281	102	114	50	88
Mauritania	115	182	48	106	77
Mozambique	62	368	34	155	73
Niger	155	89	75	11	73
Nigeria	389	2,441	7	0	91
Rwanda	3	16	19	15	104
Senegal	341	458	28	153	76
Sierra Leone	72	58	10	12	81
Somalia	42	432	110	330	65
South Africa	127	476	—	—	104
Sudan	125	305	50	195	102
Tanzania	431	265	148	237	91
Togo	6	62	0	4	90
Uganda	37	37	16	57	86
Upper Volta	99	71	0	51	94
Zaire	343	538	—	17	96
Zambia	93	295	1	84	92
Zimbabwe	56	21	—	18	92
Total	3,880	9,099 (+134%)	876	2,213 (+153%)	91[a]

[a] Average (mean), weighted by population.

SOURCE: World Bank, *World Development Report, 1983,* In: U.S. Congress, House Committee on Foreign Affairs, *Feeding the World's Population: Developments in the Decade Following the World Food Conference of 1974* (Washington, DC: U.S. Government Printing Office, 1984), p. 76.

AGRICULTURAL SYSTEMS IN SUB-SAHARAN AFRICA

Sub-Saharan Africa is at least twice the size of the entire U.S. and is made up of 45 countries (fig. 1, ch. 1) with diverse climatic, environmental, cultural, socioeconomic, and political characteristics. To understand the limitations and possibilities of increasing food production in Africa, it is essential to examine African agricultural systems carefully. Varying soils and climatic and ecological factors define a multitude of ecological systems ranging from the hot, humid rainforests of the Congo River Basin, to the highlands of Kenya and Uganda, to the tall and short grass savannas that grade into the Sahara Desert to the north and the Kalahari and Namib Deserts to the southwest. For a more in-depth analysis of African agricultural systems, see Moran (1979) and Ruthenberg (1980).

Despite the considerable diversity of agricultural systems in Africa, some broad generalizations can be made regarding "typical" characteristics and general trends.

Of the approximately 400 million people in Africa, at least 70 percent live in rural areas. The vast majority of these represent subsistence farmers and pastoralists. While production generally is geared toward subsistence levels, these low-resource producers also provide the major source of food for the rural and urban sectors, and raw materials for export and domestic manufacturing (Lele, 1981). With 30 to 60 percent of GNP being derived from agriculture, the need for a healthy agricultural sector is evident.

Africa is often misleadingly characterized as having low population densities and abundant availability of land (Moran, 1979). While these factors might suggest favorable conditions, in large measure they simply reflect the poor environmental condition of much of the continent: low, unreliable rainfall and poor soils. In fact, human populations in Africa tend to be strongly clustered around water supplies, roads, and areas with better soil. Even where populations are low in absolute terms, they are high relative to the limited carrying capacity of the land. Large areas of land are not available for settlement because of rock outcrops, tsetse flies, river blindness, or other similar causes. On most of the remaining land, once one takes into account carrying capacity, the population is sufficient to stress the environment (Moris, 1984).

Fourteen sub-Saharan countries have inadequate amounts of land "to support on a sustainable basis populations as large as those already reached in 1975" assuming subsistence food levels (World Bank, 1984b). These countries represent one half of the 1981 populations and approximately one-third of the region's land area.

Land tenure patterns, though changing, are relatively egalitarian. Farms are generally small, with 2 to 10 acres under cultivation at any one time (Eicher and Baker, 1982). Labor comes from the entire family with women playing a major role in food production and contributing significant labor to cash crop production and animal rearing. Land preparation traditionally has been accomplished through slash and burn techniques and planting has been rotated with long fallow periods, usually at least 8 years. Because of increased population pressure on land, however, these practices are becoming less and less prevalent.

Farmers often engage in intercropping—the staggered planting of several varieties of crops in the same field. Although often not recognized as such by outsiders, these complex cropping patterns are adaptations to the delicate environment in recognition of the soil's susceptibility to leaching and erosion. Intercropping also is less risky and better suited for subsistence farming to provide family food supplies. For similar reasons, farmers sometimes cultivate several separate fields simultaneously. Intercropping has the particular benefits of providing extended soil cover for moisture retention, making better use of soil and water, and decreasing weed growth.

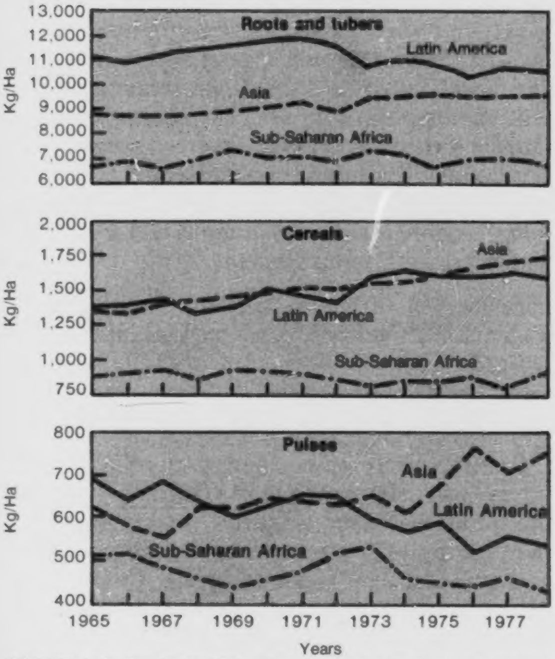
Farmers in Africa make relatively little use of systematic irrigation or commercial inputs such as fertilizers. Yields per hectare of staple crops are lower in Africa than in other developing regions (fig. 4).

Availability of arable land, until relatively recently, was sufficient in most countries to sustain the traditional (land extensive, low input, rotational, long fallow period) agricultural systems without presenting major problems. Today, however, increased population pressure has resulted in increasing pressure on the land. The need for increased production has led to expanded use of marginal land with low and unreliable productivity. In addition, fallow periods have been reduced leading to even further declines in yields. Savannas, which traditionally have been used for herding, are now being converted to permanent cultivation. These factors contribute to serious degradation of the natural resources.

Cattle and other livestock play a critical role in the total economy of many African countries, particularly in arid and semiarid areas where agricultural production is more uncertain. In evaluating agricultural development schemes and evolving agricultural systems, particularly mixed crop-livestock systems, it is important to understand the role livestock play and can play as a source of food and investment (see Box A). Practically all producers maintain some form of livestock. In some circumstances livestock can use available resources more effectively than crops

(Henson, 1984). Livestock can also represent the major source of cash flow for low-resource producers, an important factor to consider when examining strategies for enhancing yields that require the farmer to purchase inputs (Brumby, 1984).

Figure 4.—Sub-Saharan Africa, Asia, and Latin America Yields for Staple Crops



SOURCES: Latin America and Asia—Food Production Yearbook, Sub-Saharan Africa-ESCS estimates, *In:* U.S. Department of Agriculture, *Food Problems and Prospects in Sub-Saharan Africa*, Foreign Agricultural Research Report No. 166, August 1981.

Photo credit: Emment George, U.S. Agency for International Development

Livestock products supplement the protein supplies, income, and prestige of many African households, in addition to contributing foreign exchange as exports. In mixed farming systems, livestock also are used for plowing. Here, two Maasai herders watch over cattle in Tanzania.

U.S. INTERESTS IN ASSISTING DEVELOPING COUNTRIES

> The United States is in a real sense the creation of European foreign aid, received in relatively small amounts at critical points in our history, applied with energy and ingenuity by Americans to American resources . . . .The early experience of the United States demonstrates the value of foreign aid for the military security and economic development of a young, threatened, and relatively poor nation. With the help of foreign grants, military assistance, loans and other capital investments, the national independence of the United States was secured, our essential economic foundations established, and our own economic development begun (U.S. AID, n.d.).

The United States began its own foreign aid programs with the Marshall Plan, the massive U.S. assistance program to rebuild Europe after the devastation of World War II. Aid to developing countries officially began in 1950 when Congress passed the Act for International Development. Despite the proliferation of U.S. foreign aid legislation and changes in strategy and focus, the reasoning for U.S. interest has remained fairly constant.

In general terms, foreign aid is seen as a mechanism to promote U.S. economic and national se-

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Box A.—Trends in Livestock Development

The Sahelian drought of 1968-74 focused international attention on African pastoral societies. The overgrazing and famine that followed the absence of rains convinced some environmentalists (Hardin, 1968; UNCOD, 1977) and economists (Monod, 1975; Konzacki, 1978) that traditional pastoral societies failed to manage their resources effectively.

Based on this assumption, range management interventions were supported by both the Agency for International Development (AID) and the World Bank. The early projects either attempted to settle the pastoralists within western style ranches (to introduce range management techniques for the increased marketing of the animals) or to "expand" grazing opportunities into seasonal rangeland by drilling deep wells. However, these interventions generally caused severe deterioration of the range and adversely affected socioeconomic conditions. Proliferation of wells in the Sahel introduced additional livestock into seasonally grazed areas and caused severe overgrazing (Clark, 1977; Glantz, 1976). Ranches introduced in East Africa and Botswana have shown disastrous results, in some cases, completely degrading both the vegetation and soils of the area (Horowitz, 1979; Banks, 1981).

Now a growing awareness exists of the complexity of livestock systems in Africa. "They differ strikingly on the degree of movement involved, from highly mobile nomadic systems to relatively sedentary ones . . . . In some of the intermediate rainfall areas, livestock production is integrated with cropping and farmers take care of their own animals . . . " or in other areas " . . . crop producers consign animal care to specialized herder groups" (Institute for Development Anthropology, 1982). Within livestock production systems, livestock serve many purposes. They serve as a source of milk, meat, social prestige, capital, savings, draft power for plowing, and insurance against drought (Hjort and Dahl, 1976; Institute for Development Anthropology, 1982).

Several national and international research centers now generally agree on the types of research that can appropriately benefit livestock producers (Horowitz, 1979). The systems approach used to integrate livestock and cropping systems shows promise in providing solutions to problems of low-resource producers. One organization, the International Livestock Centre for Africa (ILCA), views poor animal health and nutrition during dry seasons as the main constraints to increased production. ILCA emphasizes research on mixed farming systems as its main objective, providing a forage-legume link between cropping and livestock enterprises and increasing yields in both. Alley cropping, for example, can increase crop yields and provide browsing for small ruminants by intercropping trees such as leucaena with cereal crops. In the semiarid zones, intercropping millet and cowpeas can increase yields and improve the value of forage (ILCA. 1984).

ILCA and others are conducting research in arid and semiarid zones on the control of the tsetse-transmitted trypanosomiasis, the introduction of appropriate plows for people with few livestock, range management for communal livestock systems, and dry season water management. However, much needs to be done in improving dairy yields of livestock, exploring possible supplemental feeds, and decreasing calf mortality rates.

curity interests. More specifically, the economic argument is made that assisting the developing countries helps "convert the threat of economic chaos into long-range opportunities: the building of new trading partners, and new free societies of private enterprise" (Andreas Task Force, 1984). Developing countries represent 40 percent of U.S. export markets and are the fastest growing market, by value, for U.S. goods and services. A large part of U.S. assistance spending comes back in the form of demands for American goods and services. It has been estimated that about 70 percent of bilateral U.S. assistance disbursements and 50 percent of our contributions to multilateral development banks are spent on U.S. goods and services (U.S. Department of State, 1983). Developing countries are particularly important markets for agricultural products, with 20 percent of

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U.S. farm acreage devoted to producing for them (U.S. Department of State, 1983). Every billion dollars of farm exports generates another 25,000 to 30,000 jobs in the United States (Andreas Task Force, 1984).

In terms of security interests, aid is seen as a non-military tool to achieve numerous foreign policy objectives including:

- promoting regional and economic stability,
- encouraging democracy,
- securing or maintaining access to strategic facilities,
- countering Soviet influence,
- encouraging cooperation with the U.S. on international issues (U.S. GAO, 1983).

> The plight of the developing world poses a threat to our own security. A contented United States cannot live unscathed in a world of hunger and famine. Nor can the United States live unharmed in a world of seething unrest and unstable governments that hunger and famine creates (Andreas Task Force, 1984).

The United States depends on developing countries for a number of important commodities and Africa possesses a significant share of many of these. For example, the United States imports over 90 percent of its cobalt, bauxite, and manganese. Zaire and Zambia are the world's leading producers of cobalt and together provide about 50 percent of U.S. import requirements. Guinea has more than a quarter of the world's bauxite reserves and provides some 30 percent of U.S. imports. Gabon provides 26 percent of total U.S. import requirements of manganese, which in 1983 reached 99 percent (Kamarck, 1982; U.S. Department of the Interior, 1984a,b).

Each of these materials has vital industrial and military applications. Concern exists that strategic materials from Africa are particularly susceptible to interruption due to instability in many supplier countries. The argument is made that economic assistance acts as a stabilizing factor and cements U.S.-supplier country ties, thereby reducing the threat of supply disruptions.

Beyond the arguments related to U.S. economic and security interests, more altruistic motivations historically have played a large part in development assistance. The arguments of humanitarian or moral obligations to alleviate suffering in the world have been used effectively to generate considerable support, particularly during periods of crisis such as drought, famine, and other natural disasters.

Conflicts may arise between U.S. interests in assisting sub-Saharan African countries and broader domestic and foreign policy goals. In particular, the objective of making Africa more food-self-sufficient may conflict with United States desires to expand international markets for its agricultural products. The Overseas Private Investment Corporation (OPIC), the Federal agency created to mobilize and facilitate "the participation of U.S. capital and skills in the economic and social development of less developed countries," places high priority on export development. However, the General Accounting Office (GAO) notes that OPIC should "explore possible conflicts which might arise between country development objectives and U.S. export interests" (U.S. GAO, Feb. 1981).

> The objective of greater agricultural development in the Third World quickly confronts the question of competition with U.S. exports for existing markets. Short-run competitive relationships will, of course, arise. However, the real interest of American agriculture is in expanding the total world market . . . rather than obtaining slightly larger shares of a stagnant or shrinking market (Andreas Task Force, 1984).

The divergence of interests, however, threatens to widen, especially given U.S. efforts to expand its agricultural exports significantly in the short term as a means of reducing its overall trade deficits. This issue raises a number of issues relating to agriculture, technology, and assistance for sub-Saharan Africa which the Congress should address.

> Agricultural surpluses traded on new international markets transformed the United States into the prime world agricultural exporter. This provoked a continuing debate regarding the appropriate U.S. role in world agriculture: Should the United States be the "breadbasket of the world" (with potential long-run depletion of its natural resources)? Or should the United States act as technical assistance provider to help less developed countries strengthen their own agricultural systems (with long-term prospects of LDCs reducing their need for American agricultural imports and eventually even competing with U.S. imports in world markets)? (USDA, 1984c).

Chapter 3

Issues in Technology Development

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Issues in Technology Development

The best hope for increasing food supplies in Africa lies with the low-resource farmers and herders who provide an overwhelming proportion of the region's food. Yet can these people be helped to increase their production enough to feed today's populations, let alone the additional millions who will be added as Africa's population grows?

American expertise can have a role in this effort. This section explores the types of technology needed to face this future growth, including the role agricultural research plays in developing suitable technologies. In particular, it looks at what types of technology are suitable for African cultures and environments. Later sections of this report focus on issues in technology transfer, technical assistance, and the responsibilities of the African governments themselves.

The issues examined here include the suitability of existing technologies and their appropriateness for conditions likely in Africa's future, the indirect role that nonagricultural technologies can serve to increase food production, how the United States and other nations can best share their scientific and research expertise, how current research information can be shared most effectively, and the need for food producers to have an expanded role in planning and implementing agricultural research.

Issue 1: Many technical solutions introduced into sub-Saharan Africa for food production are not suitable for present conditions nor for conditions likely to prevail in the near future.

Preliminary Findings

- Increased food production requires increased use of well adapted existing technologies and new ones. The most suitable technologies probably will be consistent with traditional African agricultural methods, reflect local conditions, be affordable, locally produced and repairable, and involve low risks and low inputs.
- Large demographic changes are under way in Africa, and innovative agricultural technologies relevant to these changes—e.g., urban agriculture—are needed but largely unexplored.
- Few technologies have been designed for low-resource food producers who generally seek to minimize risk rather than maximize production. A growing consensus is emerging that developing these technologies deserves high priority.
- Technology development should consider the status of the natural resource base, its inherent capabilities, and the potential impacts of new technologies, but often this is not done. Resources are degraded or susceptible to degradation in many parts of Africa. Important differences exist between the African and U.S. resource base.
- An integrated or "systems" approach to technology development is promising but seldom taken. Too often technologies are developed piecemeal with little regard for long-term sustainability. For example, work on crops and trees is not integrated with animal production systems even though many producers combine them.
- The social and cultural situations into which technologies are introduced are vital but often overlooked—e.g., often women's unique roles in African agriculture, pastoralism, and forestry are underemphasized.
- Conditions in the United States are significantly different, ecologically and socially, for most agricultural technology developed in the United States to be transferred directly to sub-Saharan Africa. Much U.S. technology requires levels of technical and managerial support that now cannot be met in Africa.
- Expanded agricultural research is needed on traditional staple food crops and small-scale food production instead of continued emphasis on cash crops.

Discussion

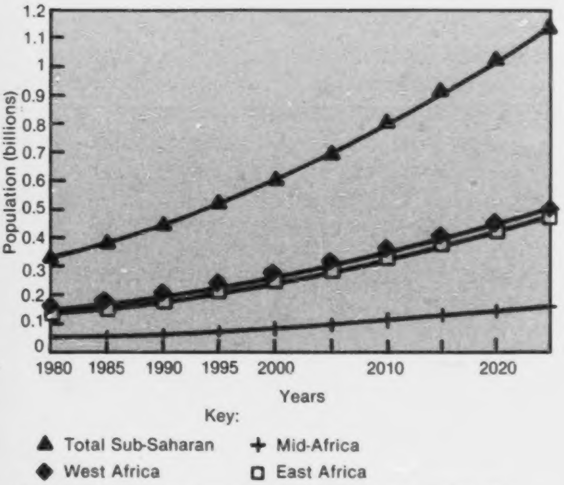
The decline in per capita food production in Africa has stimulated a reexamination of the types of agricultural technology chosen for development and transfer. Hindsight has shown that introduction of Western technologies into peasant communities often has proved inappropriate (Altieri, 1984; Harwood, 1979). Some agricultural technology has worked against the natural resource base, further undermining food production (Commins, 1984; Twose, 1984). Also, population distribution between inland/coastal and rural/urban areas is shifting and total population is increasing rapidly (figs. 5 and 6). As such, specialized technologies may be needed to produce sufficient food. Large demographic shifts, continuing environmental degradation, as well as numerous project failures, suggest that some changes in technology development are needed.

A consensus is emerging on the kinds of technology most needed to meet Africa's future food needs. Participants in OTA's workshop described these technologies as: low risk, resource-conserving, small-scale, locally produced, affordable, easily repaired, and based on traditional methods. Also, technologies must be suited to labor conditions because "production cycles alternate short periods of intense work, requiring a *seasonally* effort-saving form of investment and input, with long periods of 'underemployment' " (Lipton, 1977c). Participants also noted, however, that many technologies must be tailored to the particular site of application and the expected users. Therefore, generalizations cannot be made about the best technology for all types of production, regions, and countries because of the varied conditions and varied agricultural production systems.

The adaptation and use of traditional agricultural methods is expected to be an essential starting point (U.N. FAO, April 1984; Wad, 1984). Traditional agricultural systems include: agroforestry, multiple cropping, minimum tillage, cover cropping, living mulches, small-scale irrigation, and large and small livestock management. Commonly, traditional technologies have been overlooked by researchers, governments, and donors despite their prevalence and advantages. For example, 98 percent of cowpeas grown in Africa are interplanted with other crops (Francis, et al., 1976). Yet intercropping has received little research attention. This is a traditional technology to:

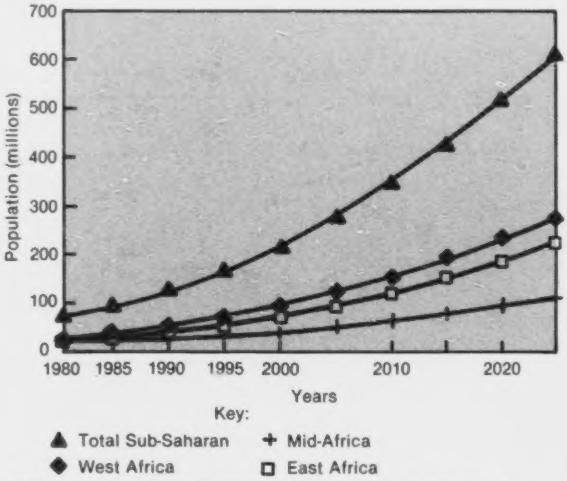
> . . . promote diversity of diet and income source, stability of production, minimization of risk, reduced insect and disease incidence, efficient use of labor, intensification of production with limited

Figure 5.—Population Projections for Sub-Saharan Africa: 1985-2025



SOURCE: United Nations Population Projections, Medium Variant, 1980.

Figure 6.—Urban Population Projections for Sub-Saharan Africa: 1985-2025



SOURCE: United Nations Population Projections, Medium Variant, 1980.

Photo credit: George Scharffenberger, OTA

Traditional agricultural methods are appropriate starting points for developing improved agricultural technologies. IITA is researching the traditional risk-reducing, yet efficient, practice of intercropping (e.g., cowpeas and cassava).

resources and maximization of returns under low levels of technology (Altieri, 1983).

Kitchen gardening, an agricultural activity performed almost exclusively by African women, is another largely neglected traditional technology. These gardens often contribute to household income, show higher per-acre yields than field crops, and are the places where producers experiment with new seeds, new inputs, and new planting technology. Yet often they are perceived by donors and researchers as women's hobbies and usually do not receive funding, inputs, technical assistance, nor research in proportion to their importance (Tendler, 1982).

Urban agriculture is another use of traditional technologies that may be of increasing importance. Almost all African countries are urbanizing more rapidly than other low- and middle-income countries while overall development is slower; most growth is occurring in each country's largest city (PADCO, 1982). Many urban residents face problems obtaining affordable and reliable food supplies, although food prices have been kept artificially low in many urban areas. Urban Resource Systems, Inc., estimates that the incidence of malnutrition is accelerating more rapidly in cities than rural areas of developing countries and that the urban poor consume fewer food calories than their rural counterparts.

"Meanwhile, for millions of the urban poor, the potential capacity of the urban system to produce food may be a factor on which their survival may hinge" (Boyden and Celecia, 1981; Nelson and Mandl, 1978). Methods such as intensive cultivation, rooftop gardening, composting, urban forestry, irrigation using renewable energy for pumping, aviculture, and aquaculture can be used to increase urban food supplies.

Urban agriculture projects exist in some African countries, their contribution to nutrition is documented, and their special importance during food shortages is easily observed (see Urban Resource Systems, Inc., 1984). For example, open lands are used by the unemployed to grow vegetables and fuelwood in Addis Ababa, Ethiopia (OXFAM, 1983; Wade, 1983). The City Council in Lusaka, Zambia, began an Urban Agriculture and Nutrition Project in 1977 (Wade, 1983), receiving some assistance from UNICEF and an American PVO.

This program maintains demonstration vegetable gardens in several squatter settlements and on urban fringe lands. Lusaka planned a special urban agriculture and nutrition service to promote urban food production (Ledogar, 1978). Home food production also is part of a local development plan for areas near Douala, Cameroon (Barbedette, 1978).

Steady use of many kinds of existing technologies during the 1980s and 1990s could increase food production substantially. First, however, African countries would need to determine and eliminate non-technological constraints, such as pricing policies. Africa also faces a number of special technical problems requiring new technological approaches. Important research areas include: plant breeding for unfavorable environments, soil and water conservation, environmental monitoring, mechanization, fodder crops, livestock immunization, fisheries estimates, and livestock management. The aim should be:

> . . . small scale but highly productive and ecologically sound permanent farming systems that not only take advantage of such modern inputs as better varieties, mineral fertilizers and mechanical equipment, but also make full use of crop residues for animal feedings, and of crop and animal residues and nitrogen-fixing crops to maintain fertility. These are likely to be increasingly based on the close integration of crop, livestock and forestry production, and in some cases fish production as well (U.N. FAO, April 1984).

Research to help develop such technologies seems to be scarce. As much as 98 percent of the

Photo credit: George Scharffenberger, OTA

Alley-cropping food crops (e.g., maize) with nitrogen-fixing bushes (e.g., gliricidia) is an adaptation of intercropping designed to increase yields as well as provide fodder and/or fuelwood.

world's modern technological capacity is concentrated in the industrialized countries (Singer, 1977). An estimated 90 percent of all scientific research conducted worldwide takes place in developed countries and is directed specifically to their own needs (Perez, 1978).

Trends in American agriculture make it unlikely that most U.S. technologies will be appropriate for Africa. U.S. research on small farms, for example, comprises only a fraction of the annual Federal research budget. Plant breeders in the United States generally have not sought to adapt crops to unfavorable environmental conditions (Boyer, 1982) and research on technologies to limit farm and ranch inputs such as water, fertilizers, and pesticides has not received much attention. A few notable exceptions exist, however, such as research conducted at the Rodale Research Center in Pennsylvania (U.S. Congress, OTA, Oct. 1983). Some experts contend, though, that the technical feasibility of developing "low-input" technology for agriculturally marginal areas is unknown (Ruttan, 1982).

Much American agricultural technology has been described as "high tech." It involves complex and expensive machinery, integration of large amounts of information from distant sources, and high managerial skills. These features significantly limit its applicability in Africa. In addition, U.S. climate, soils, natural vegetation, and domesticated animals are different in important ways from those in Africa. Therefore, American technology commonly is not suitable for direct transfer overseas, and care must be taken to evaluate its suitability before introduction.

Some argue, however, that much developed-country research is adaptable or transferable to developing countries. Authors of the 1971 U.N. World Plan of Action called for developed countries to divert a specified part of their domestic research efforts toward technology appropriate for developing countries (Singer, 1977). Basic research on plant and animal physiology is one example. If U.S. universities conducted research on important African crops, the results would be expected to be useful in Africa.

In fact, however, Africa's staple food crops have not received major research worldwide (U.N. FAO, April 1984) and different uses of the same crops in different countries may limit widespread use of research results. Sorghum, for example, is used in the United States for livestock feed and syrup. In Africa, it is used for human food and brewing beer. These uses require different crop research strategies. Research programs for millet, cassava, yams, cowpeas, and open-pollinated corn have begun only recently, and "the scale of worldwide research effort on individual staple food crops has been in inverse ratio to their importance in Africa" (U.N. FAO, April 1984).

U.S. technology, in its broadest definition, is used extensively to train many African agricultural students in the United States. Such training is often inappropriate for the conditions to which the students will return. Thus the need to provide education and training *in Africa* is stressed increasingly. U.S. training is likely to remain necessary in the short term until African educational institutions can fully develop. Indigenous institutions, American faculty, and foreign students in the U.S. could benefit if foreign graduate students at American universities conducted research in their own country or in countries having similar environments.

Congress has attempted to encourage a new generation of technologies for developing countries. In 1975, the Agency for International Development (AID) was directed to support the development and dissemination of "capital-saving technology" in section 107 of the International Development and Food and Assistance Act. AID defined this as technology that: requires little capital per worker, is small-scale, easily replicable, easily serviced and operated by untrained users, and involves local people and resources. AID responded by establishing a private nonprofit group, Appropriate Technology International (ATI), providing policy directives to missions, and designing two systems to make technological information available to project staff.

Despite this encouragement, problems in developing, introducing, and using such technologies continue. An analysis conducted by the General Accounting Office (U.S. GAO, 1984) found that AID's management does not encourage use of capital-saving technology, that the information systems have severe weaknesses, and that ATI is used little by AID country missions. Another analysis found that capital saving technology projects compared favorably with "appropriate technology" projects in the United States but almost all were plagued by planning and/or implementation problems (Associates in Rural Development, 1982). AID evaluated ATI's worldwide work in 1982 and found that it seems to have had little impact in the four African countries studied, but the potential is growing in Kenya (Samper, 1982).

Issue 2: The development of some types of nonagricultural technologies is important to enable women farmers and herders to increase food production as well as to ensure that foreign assistance reaches the poorest rural residents.

Preliminary Findings

- Poor rural residents without land may benefit more from nonagricultural assistance and technologies—e.g., income-generating projects such as soap-making or crafts.
- Certain labor-saving household technologies could allow women producers to devote more time to agriculture. These include improved water systems, more accessible fuelwood supplies, and improved methods for processing, storing, and preserving foods.
- Improved human and animal health also are important factors in increasing food production.

Discussion

With the New Directions legislation of 1973, the goal of helping those most in need in developing countries became an explicit part of U.S. foreign assistance. The results of this directive are far from clear, however, and questions remain about the size and structure of the poorest populations in sub-Saharan Africa and elsewhere (Tendler, 1982). These unanswered questions have important implications for technology development. A large part of the income of the poorest farm households may be earned in nonagricultural activities (Chuta and Liedholm, 1984). For these people, activities such as small-scale trading, crafts, fishing, and peddling, may be important (Tendler, 1982). Only some of these activities require agricultural technology.

Time to devote to agriculture can be a limiting factor for women producers in Africa. Increasing agricultural production may depend, therefore, as much on developing improved technology to save them time in other activities and at crucial periods during the growing season as it does on improved agricultural technology.

Most rural African women work 9 to 10 hours a day in the fields, then spend as many as 7 or 8 more hours fetching water, collecting and carrying fuelwood, looking after children and the

Photo credit: World Bank Photo by Ray Witlin

A woman in Burkina Faso roasting groundnuts while watching her child. Nonagricultural technologies that reduce some of the labor constraints that women face in fuelwood and water collection could allow them more time for agricultural activities.

elderly, cooking and preserving food, and helping to store and market crops (Carr, 1978). Also, they may grow vegetables or make soap to earn cash for school fees and food items such as salt and sugar. And they take part in community projects such as building roads.

Technologies intended to provide lighting and increase the efficiency of cooking have attracted much attention as ways to lighten women's burdens. Planners felt that improved stoves, for example, could decrease alarming deforestation and reduce time spent on fuelwood collection. Many of these projects have been less successful than was hoped, however. It seems that the time women spent collecting fuelwood and the magnitude of deforestation attributed to their activities were overestimated (Tinker, 1982). In addition, sometimes the perceived needs of women differed from what projects offered. More recent efforts—e.g., to introduce solar ovens and make simple adjustments to currently used stoves—are more successful (Tinker, 1982).

African women themselves have identified the need for new water technology to ease the burdens of carrying water daily for drinking, cooking, washing, and irrigation:

> Evidence shows that life for the rural woman has been getting harder over recent years. Worsening drought conditions in many African countries mean that women have to walk further distance and for more months during the year to collect water. A recent study in Ethiopia revealed that in 75 percent of the households under survey, the women spent 3 hours or more on a single journey to collect water. Women in many villages in Upper Volta set out to collect water at dawn and rarely return with their daily supply before noon (Carr, 1978).

Evidence exists that food production may increase when water technology improves. In Kenya, for example, the installation of tin roofs for rainwater collection saved 2 to 10 hours per day per household. Women expanded their gardens and raised more chickens and pigs for urban markets as a result (Tinker, 1981).

African women also have noted the need for technologies suited for transporting small loads of fuelwood, water, and produce, and improved technologies for food processing. The latter include grinding mills for producing flour from corn, millet, sorghum, and rice, a task that can take 1 to 2 hours each day (Carr, 1978). Some estimates suggest that food processing and preparation take more time and energy than either collecting firewood or water (Tinker, 1982).

Considerable evidence exists that disease is an impediment to agricultural development and thus food production in some parts of Africa (Ruttan, May 1984). Agriculture is impossible due to onchocerciasis (river blindness) in some fertile river valleys in West Africa. It appears that disease vectors increase as cultivation increases, eventually causing abandonment of the cleared land. Trypanosomiasis, carried by the tsetse fly, is a serious public health problem, and it makes livestock production impossible on approximately 6 million square miles of land. Technologies are available to prevent or cure some tropical diseases but often their application is costly. Research in biotechnology may make new low-cost technologies available but its application is, in some cases, decades away (U.S. Congress, OTA, 1985).

Issue 3: Disagreement exists regarding the optimal way for the United States to support scientists and provide funds for research on African food production.

Preliminary Findings

- An integrated system of national and regional agricultural research institutions in developed and developing countries tied to the international research network has great potential but has yet to be achieved.
- U.S. contributions of personnel and funds to the International Agricultural Research Centers have been vital to their substantial successes.
- National agricultural research centers in Africa need strengthening and this could require a major U.S. commitment.
- American institutions have played and continue to play important roles in educating African scientists. The tailoring of certain programs could be improved to fit the situations students face at home—e.g., by providing in-country

training or training in comparable developing countries.

- Few U.S. universities can sustain the long-term commitment required for African technology development and transfer because: 1) funding is tied to short-term contracts and assignments, 2) the number of American scientists with training and experience under conditions different from the U.S. temperate zone is limited, and 3) few U.S. universities and colleges provide incentives for faculty to conduct overseas agricultural research.
- Arguments exist regarding the best roles for American scientists and universities to play in African development. Some universities are attempting to "internationalize" their charters and to increase their involvement in development. At the same time, some developing countries seek to decrease the role of expatriates, limiting opportunities for U.S. personnel.
- Non-land grant universities and smaller land grant institutions have not played a large part in international agricultural development efforts.
- The 1890 colleges have conducted research for small, low-resource farmers in the U.S. Their expertise may prove to be relevant to developing countries. Long-term overseas work may jeopardize their local programs, however, because their scientific staff usually is small.

Discussion

Many experts acknowledge that the global agricultural research system has weaknesses that need to be improved (Eklund, 1983; World Bank, 1984a). However, they have not agreed on the best way to achieve this nor the optimal roles of the different institutions that comprise the system: the international agricultural research centers, national and regional agricultural research institutions in Africa, and developed-country research facilities, especially universities.

Most American assistance for multilateral agricultural research is channeled through the global network of international agricultural research centers funded by the Consultative Group on International Agricultural Research (CGIAR). Thirteen centers exist; four are located in Africa and most of the others have significant programs there (table 3; app. A). The United States has provided 19 to 28 percent of the annual core funding for CGIAR since 1972 (CGIAR, 1983).

The Centers have contributed to increases in food production in developing countries and generally are regarded as successful innovations (Schultz, 1984). Their greatest impact has been in breeding high-yielding varieties of wheat and rice (Plucknett and Smith, 1982). The perception exists that they have made the "easy" research gains, though, and are beginning to lag in using recent biological advances (Ruttan, 1983). Funding is expected to remain relatively constant after spectacular increases in the 1970s.

Debate continues regarding the proper level and form of U.S. support for CGIAR. Some note the increase in U.S. bilateral assistance and fear that the longstanding U.S. commitment to CGIAR is waning (Scharffenberger, 1984). On the other hand, some U.S. university officials contend that AID allocates money to the international centers at the expense of support for American institutions (Campbell, 1983).

Most experts, however, recognize the need for a cooperative, not competitive, global agricultural research system. Also, a consensus exists that national and regional facilities in Africa deserve increased support in order to make the entire system most effective (Lele, 1981; World Bank, 1984a). Links between the international and national centers are important as well as links among national institutions (Ruttan, Sept. 1984).

National agricultural research centers in developing countries expanded greatly in the last decades. Most of the growth occurred in a few countries, however, and Nigeria is the only African nation among them. Ruttan (Sept. 1984) lists several concerns regarding these national efforts in Asia, Latin America, and Africa:

- investment in facilities appears to exceed that in scientific staff development,
- administrative burdens stifle research,
- frequently locations are chosen without adequate regard for factors that contribute to success,
- often research budgets do not reflect the economic importance of particular commodities,

Table 3.—Centers Supported by the CGIAR, 1984

Acronym (year established)	Center	Location	Research programs	Geographic focus	1984 budget[a] (millions of dollars)
IRRI (1960)	International Rice Research Institute	Los Banos, Phillipines	Rice	Global	22.5
			Rice based cropping systems	Asia	
CIMMYT (1966)	Centro Internacional de Mejoramiento Maiz y Trigo	Mexico City, Mexico	Maize	Global	21.0
			Bread wheat	Global	
			Durum wheat	Global	
			Barley	Global	
			Triticale	Global	
IITA (1967)	International Institute of Tropical Agriculture	Ibadan, Nigeria	Farming systems	Tropical Africa	21.2
			Maize		
			Rice		
			Sweet potato. yams	Global	
			Cassava, cowpea, lima bean, soybean	Tropical Africa	
CIAT (1968)	Centro Internacional de Agricultura Tropical	Cali, Colombia	Cassava	Global	23.1
			Field beans	Global	
			Rice	Latin America	
			Tropical pastures	Latin America	
CIP (1971)	Centro Internacional de la Papa	Lima, Peru	Potato	Global	10.9
WARDA (1971)	West African Rice Development Association	Monrovia, Liberia	Rice	West Africa	2.9
ICRISAT (1972)	International Crops Research Institute for the Semi-Arid Tropics	Hyderabad, India	Chickpea	Global	22.1
			Pigeonpea	Global	
			Pearl millet	Global	
			Sorghum	Global	
			Groundnut	Global	
			Farming systems	Semi-Arid tropics	
ILRAD (1973)	International Laboratory for Research on Animal Diseases	Nairobi, Kenya	Trypanosomiasis	Global	9.7
			Theileriosis	Global	
IBPGR (1974)	International Board for Plant Genetic Resources	Rome, Italy	Plant genetic sources	Global	3.7
ILCA (1974)	International Livestock Center for Africa	Addis Ababa, Ethiopia	Livestock production systems	Tropical Africa	12.7
IFPRI (1975)	International Food Policy Research Institute	Washington, DC, U.S.A.	Food policy	Global	4.2
ICARDA (1976)	International Center for Agricultural Research in the Dry Areas	Aleppo, Syria	Farming systems	Dry areas of West Asia and North Africa	20.4
			Wheat, barley, triticale, broad bean, lentil, chickpea, forage crops		
ISNAR (1980)	International Service for National Agricultural Research	The Hague, Netherlands	National agricultural research	Global	3.5

[a] CGIAR supported core budget, net of capital, at the bottom of the bracket (from 1983 Integrative Report).

SOURCE: Consultative Group on International Agricultural Research, "The CGIAR in Africa," Washington, DC, 1984.

- analysis of research priorities is not well-informed,
- leaders of some research systems appear to presume that research can be done without scientists,
- a number of national systems are vulnerable to cycles of donors' development policies.

Ruttan notes further that both African governments and donors will face critical questions as they develop national agricultural research facilities. Most smaller countries, with populations ranging from 2 million to 10 million, have the resources to develop their own research systems in 10 to 20 years. National research systems in smaller developing countries, such as Sierra Leone, may require a generation to reach their ultimate size—little larger than a branch station in Texas. They will remain dependent on the international agricultural research centers, multinational firms, and developed countries for much agricultural technology. But they need the scientific capacity to draw on the global research system.

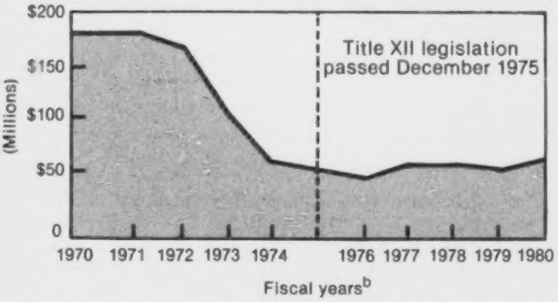
U.S. universities are an important part of that global system and have been involved in international work for decades. Massachusetts State College worked with Japan in 1876; other universities followed in the early 1900s. The pace accelerated after 1949, when President Truman dedicated the United States to helping developing countries. Large numbers of U.S. university faculty work in developing countries now. Washington State University, for example, has formal exchange agreements with 17 countries, and more than 120 faculty had foreign assignments in 1983 (Yates, 1984).

The type of international work that universities conducted has shifted with time. In the 1950s many universities attempted to transfer American agricultural technology directly. By the 1960s their attention shifted to institution-building. These activities decreased and research efforts increased in the late 1960s and early 1970s when AID funding for universities peaked (figs. 7 and 8). More recently, universities and individual American scientists have worked with the global network of international agricultural research centers and contracted for AID mission-oriented work (Perez, 1978).

Many evaluations of universities' involvement in international activities were completed in the 1960s and 1970s. U.S. personnel made a large contribution to overseas successes, but some common problems were noted. These included: lack of long-term planning, difficulties in the AID/university relationship; lack of social, cultural, and political sensitivity on the part of the U.S. personnel; lack of planning and coordination by funders, universities, and developing country institutions; and inappropriate education for developing-country students in the United States (Perez, 1978). Some of these evaluations recommended new American institutions to remedy these problems. The Gardner Report (1964), for example, suggested forming a National Institute for Education and Technical Cooperation to take over U.S. development-related research and mobilize university involvement in developing countries.

The Federal Government provides substantial assistance to U.S. universities for international agricultural development. Few State governments have supplied the charter or the funds for similar efforts. Citizens in some States feel that their universities should work on State problems and that international work leads to increased competition for markets between local farmers and ranchers and their developing country counter-

Figure 7.—AID-Financed University Contracts and Grants for Technical Assistance to Host Countries—In Millions, Fiscal Years 1970-80[a]

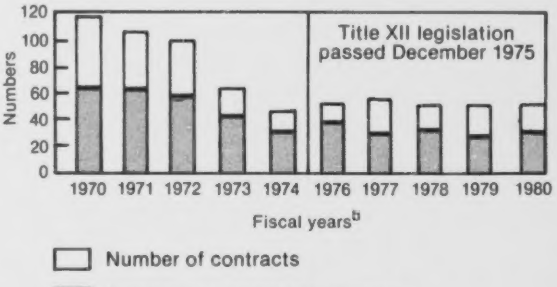


[a] Data do not include AID grants and loans involving host country contracts with U.S. universities.

[b] Data for fiscal year 1975 are not available.

SOURCE: General Accounting Office, *AID and Universities Have Yet to Forge an Effective Partnership to Combat World Food Problems*, ID-82-3, Oct. 16, 1981.

Figure 8.—AID-Financed University Contracts and Grants for Technical Assistance to Host Countries—In Numbers of Contracts and Institutions, Fiscal Years 1970-80[a]



[a] Data do not include AID grants and loans involving host country contracts with U.S. universities.

[b] Data for fiscal year 1975 are not available.

SOURCE: General Accounting Office, *AID and Universities Have Yet to Forge an Effective Partnership to Combat World Food Problems*, ID-82-3, Oct. 16, 1981.

parts. A few State universities, however, have changed their original charters to reflect their view of more global responsibilities, and Federal programs have increased universities' interest and ability to fulfill them.

> The university must provide educational opportunities that will enable the citizens of our state and nation to make sound decisions based on an awareness of the global environment in which we live and work . . . .Our students and clientele [must be] able to see the relationships that will continue to bind this country more closely to the global community . . . this I believe to be one of the premier responsibilities of the global university (Yates, Executive Vice President and Provost, Washington State University, 1984).

Title XII of the Foreign Assistance Act, passed in 1975, provides the rationale and means by which universities have become more involved in international agricultural research and development. It committed U.S. universities and colleges to help solve food problems in developing countries. The General Accounting Office reports that "Title XII has been instrumental in bringing new vigor and awareness to international work in the U.S.-university community" (U.S. GAO, 1981). But GAO also notes that U.S. universities have limited capacity to take part effectively in these AID programs due to deterrents to faculty overseas assignments, sporadic funding from AID, income tax burdens on faculty, and cumbersome AID contracting procedures. AID faces similar constraints due to skepticism in AID missions about the relevance of involving U.S. universities as "partners in development" and some experiences with poor university performance.

Some universities have not been drawn into this international work extensively, and concerns exist that Title XII contracts are awarded on the basis of geographic politics more than expertise. In addition, some technologies—e.g., biotechnologies—are being developed largely outside of the land-grant system in private universities and research firms. This raises questions whether certain technologies may be unavailable to developing countries because of the funding structure for international agricultural work in the United States. Similarly, some experts contend that the 1890 Land Grant Colleges (table 4) have not participated in overseas research in proportion to their potential. Since their creation, the 1890 institutions have been involved extensively in domestic community development under conditions that parallel those in developing countries (Williams, 1979). Shortage of qualified personnel, however, has led them, like some other universities, sometimes to substitute outside contractors on AID

Table 4.—The 1890 Institutions Were Added to the Land-Grant System to Compensate for Exclusion of Blacks From the 1862 Land-Grant Universities

Institution	Location
Alabama A&M University	Normal, AL
Alcorn State University	Lorman, MS
University of Arkansas—Pine Bluff	Pine Bluff, AR
Delaware State College	Dover, DE
Florida A&M University	Tallahassee, FL
Fort Valley State University	Fort Valley, GA
Kentucky State University	Frankfort, KY
Langston University	Langston, OK
Lincoln University	Jefferson City, MO
University of Maryland—Eastern Shores	Princess Anne, MD
North Carolina A&T	Greensboro, NC
Prairie View A&M University	Prairie View, TX
South Carolina State College	Orangeburg, SC
Southern University	Baton Rouge, LA
Tennessee State University	Nashville, TN
Tuskegee Institute	Tuskegee, AL
Virginia State College	Petersburg, VA

SOURCES: B. D. Mayberry, "Mechanisms for the Delivery of Appropriate Technology—Extension," *The Unique Resources of the 1890 Land-Grant Institutions and Implications for International Development*, Thomas T. Williams (ed.) (Baton Rouge, LA: Southern University Unemployment-Underemployment Institute, 1979), p. 42; Southeastern Consortium for International Development, Washington, DC.

projects and has resulted in an uneven achievement record.

U.S. agricultural colleges are in transition, with more women, minority, and urban students entering. The effect of these trends on the conduct and content of domestic and international research and development activities is unknown.

Issue 4: Research information on science, technology, and development is less effective than it could be because it is not adequately coordinated, shared, or disseminated.

Preliminary Findings

- Limits to the flow of research information result in needless duplication of effort and slower progress.
- Research findings sometimes are not disseminated across national boundaries and institutional affiliations.
- Advancing information technologies, such as communication satellites and microcomputers, have the potential to make large amounts of information available at low cost to users scattered around the world.
- This potential remains largely unrealized in developing countries because many lack the infrastructure to provide adequate power or to repair programming.

Discussion

Leaders in developing countries called upon the U.N. Education, Scientific, and Cultural Organization (UNESCO) for a "new world information order." One of their concerns was ensuring access to information technology. Evidence exists that problems with sharing information continue and that some of the thornier policy issues remain. For example, problems are expected to arise from different national philosophies and laws regarding flow of data and from connecting information systems across national boundaries (U.S. Congress, OTA, 1981).

Traditional methods of sharing agricultural information exist and some contend that international cooperation in agricultural research is increasing. Today, some 100 international agricultural networks exist worldwide, ranging from international nurseries to teams working on specific problems (Plucknett and Smith, 1984). Communication problems affect these groups, although most publish newsletters and hold workshops to disseminate their findings. Feedback within the network may be slow and links between networks and outside scientists may be weak.

Information dissemination on small-scale technologies is considered critical. Both Volunteers in Technical Assistance (VITA) and Volunteers in Asia organize data bases on these technologies (U.S. AID, 1981). The nature, scope, and level of information needed by various recipients varies as widely as the sources of information. "To build reliable, comprehensive, and up-to-date services is obviously a major undertaking and will be quite costly" (Singer, 1977).

Groups such as the United Nations Industrial Development Organization (UNIDO) and the International Development Centre in Ottawa, Canada, also stress the need for information technologies as development tools. In March, UNIDO suggested that developing countries build indigenous capabilities for information management. One concept it endorsed was a low earth orbit satellite as a low-cost communication tool for a variety of uses by widely scattered people (VITA, 1984). Uses might include broadcasting messages and transmitting documents, thus circumventing cumbersome international mails.

Satellite systems, like many contemporary communication technologies, rely on computers. While some developing countries have computer systems that are reliable, stories abound of computers idled because no one can use them or because simple repairs cannot be made locally. Agricultural problems in sub-Saharan Africa often result from the lack of basic infrastructure: services and facilities such as roads, tools, and repair and storage facilities may be missing. The role for elaborate technology such as computers and satellites and their actual costs must be evaluated carefully if they are to compete for funds with infrastructural development.

Generally, the United States has well-developed services for sharing agricultural research information via mail systems, telephones, libraries, and publishing houses, and the United States is a leader in advanced electronic communications. These systems are being used to benefit African countries, but problems remain. For example, computer use in the United States by government donors and private voluntary organizations (PVOs) is accelerating. Many PVOs face "significant problems in the selection of hardware and design of software" (Biddle, 1984). The Agency for International Development has a computerized system to make project descriptions and other information available. It is beset by problems, however, including lack of completeness, definitional inconsistency, and incompatibility with other data sets. The holdings of American libraries related to Africa are relatively weak. The Library of Congress, for example, does not have an extensive collection of African national documents (Moris, 1984).

Issue 5: Food producers have a limited role in agricultural research and this decreases the effectiveness of the research.

Preliminary Findings

- Experts increasingly call for greater producer involvement in identifying problems for research and in developing and testing new technologies.
- Examples suggest that this approach better ensures that research meets the needs of its users and increases the likelihood of a project's success.
- Methods of conducting and evaluating on-farm research are not well-developed.
- Many institutions working with subsistence producers are not structured to encourage involvement of farmers and herders.
- Participatory research and planning requires formal coordination among food producers, extension workers, and researchers.

Discussion

Experts in agricultural development have a growing belief that the present organizational framework of agricultural research and development does not serve the interests of many developing countries. This has prompted a search for new structures that will reach more rural people.

It is generally accepted that farmers and herders must be involved in later stages of technology transfer such as technology evaluation and extension. Studies of technology transfer in the last 30 years show that failure often resulted because clients were not involved effectively (Jedlicka, 1977).

Recent evidence indicates that producers' involvement in earlier stages—i.e., in identifying agricultural problems for investigation and planning and participating in research—is crucial also. Subsistence farmers have been effective in planning and designing research, especially in identifying important environmental features (Jedlicka, 1981). Also, farmers have carried out their own experiments, sometimes making agronomic breakthroughs before researchers (Howes and Chambers, 1979) and integrating biological, economic, environmental, and social factors in their decisions (Francis, 1981).

The challenge is to devise a system of research that involves small producers and integrates on-farm work with established national programs (Whyte, 1981). Some research of this type combines: 1) research on multiple cropping systems instead of monocultures, 2) research on the role of animals in farming systems, 3) on-farm testing in addition to experiment station work, 4) an emphasis on interdisciplinary collaboration, and 5) the participation of people responsible for extension and economic development.

This type of research has had some notable successes. The value of involving farmers in all stages of project work in Ethiopia, Egypt, Pakistan, and India has been noted (Lowdermilk and Lattimore, 1981). The unique vitality of Israeli agricultural research in which farmers are also researchers was identified recently (U.S. Congress, OTA, May 1983).

Numerous factors make such research difficult. These include nonsupportive research organizations and government agencies and the complexities of conducting on-farm research. Participatory research is a more complex form of interdisciplinary research and requires high levels of competence and experience. Few successful models of interdisciplinary research exist (Rhoades and Booth, 1983). Also, lack of political and administrative continuity among local groups and international donors is a major problem. Economic and cultural gaps between producers and researchers also may hinder cooperation.

In the United States, farmers and ranchers are involved in setting research priorities through government agency users' groups and through their representatives in farm, ranch, and commodity organizations. Attempts to involve the rural poor by developing similar organizations in Africa generally have not succeeded. Some attribute these failures to the imposition of organizations by "outsiders." They contend that meaningful participation must come about through the emergence of local people's own organizational choices, but few examples exist yet (Oakley and Marsden, 1984).

Chapter 4

Issues in Technology Transfer

Chapter 4

Issues in Technology Transfer

Developing technologies suitable for Africa is only one step in helping increase food production. Those technologies also must be adapted and disseminated among the African people. This calls for successful technology transfer—another area where the United States has expertise to share. U.S. agriculture is vastly different from African agriculture, so U.S. involvement must be considered carefully. The technologies used will need to be different, as will the extension systems used to distribute them. The most effective technology transfer will be based on unique African social and agronomic conditions.

This chapter examines a number of important issues in the realm of technology transfer. For instance, should certain groups of people be identified for special assistance? How can women, the critical labor force in African food production, be integrated more effectively into the technology transfer process—including improved access to extension services and credit? And how can extension services in Africa be improved to meet producers current needs while preparing them for the future's even greater food demands?

Issue 6: The possibility of directing agricultural project assistance to meet the needs of specific target groups continues to be debated.

Preliminary Findings

- It is difficult to define explicitly and to divide the "poorest of the poor" into categories such as smallholders, landless, and urban or rural un/underemployed.
- Directing project assistance to specific target groups may alienate those other groups excluded and the national staff and donor representatives responsible for implementing projects.
- However, if women and other disadvantaged producers are not identified as groups that require additional technological assistance, project planning and implementation may ignore their problems and benefit them little.
- Both donors and African governments need improved definitions for low-resource producers and other categories of the poor.
- A low-resource producer is one who lacks access to natural resource, economic, and/or technological inputs to overcome constraints to increased food production.
- National development plans do not necessarily indicate African governments' commitment to low-resource producers.

Discussion

The magnitude of the problem seems overwhelming; substantial numbers of poor people exist in the developing countries. However, determining the number of people who lack sufficient income for adequate subsistence remains difficult. For example, the U.N. Food and Agriculture Organization and the World Bank provide different estimates of 450 million and 1.3 billion, respectively, as the number of people living below subsistence level in all developing countries (Eicher, Mar. 1984).

There is no question that Africa contains some of the world's most impoverished countries and people.

> A few statistics provide stark evidence that Africans are the poorest of the world's poor. Three out of five are chronically malnourished. Twenty-two of the world's 36 poorest countries are in Africa. For every 1000 African children born, 120 will die before their first birthday. Eighty percent of the continent's population have no access to adequate health services and only one in four has safe water to drink. Africans die sooner (average age 49) and are less literate (only 36 percent) than in any other part of the world (Swift, 1984).

Other figures are equally disturbing. For example, Kenya and Ethiopia had 55 and 68 percent, respectively, of their 1975 populations below an income level sufficient to provide adequate nutrition (Chenery, 1979). The total number of poor is difficult to estimate, as are the relative numbers between countries. Compared with Tanzania, which has an annual per capita GNP of $280, Chad, with only $80 per capita, seems dismally poor. But Tanzania has an official inflation rate of 13 to 30 percent and scarce foreign exchange. Both of these factors severely affect the poorest 20 percent of the population. Zimbabwe, on the other hand, is classified as a middle income country with an average per capita GNP of $850. But the country experiences large differences in income distribution. How can the poor of Zimbabwe be compared with those of Chad and Tanzania?

Economic development has many definitions and models. Concern about beneficiaries is common. "Trickle down" or "over" or "up" indicate perceived mechanisms for ensuring distribution of the returns from agricultural production. Some technological developments have been relatively class neutral. In Zimbabwe, introduction of the maize hybrid SR 52 was adopted by a large majority of small farmers (Eicher, 1984). Generally, however, research, economic, and extension institutions have developed and transferred technology, information, and benefits to relatively few farmers. Development assistance has not been directed toward the poorest of the African countries, either in total assistance (Lappé, 1980), or as agriculture, nutrition, and rural development assistance (U.S. AID, 1984). Some of the more disadvantaged smallholders lack reliable access to affordable land, credit, and labor and receive less development assistance than "progressive" farmers (Wortman and Cummings, 1978).

U.S. development assistance, since 1973, has been mandated to help the poorer segments of the rural population. However, given the present levels of development assistance and the project approach used by AID, difficult problems exist in assisting target groups. The problems include lack of target group definitions, unreliable data on these groups, and lack of sustainable and replicable agricultural development programs that will reach them (Tendler, 1982; Esman, 1978). In rural areas, for example, how do the "poorest of the poor" differ from smallholders or subsistence farmers? Are the "poorest of the poor" actually farmers or are they the landless rural inhabitants or migrants to the satellite communities of the larger urban areas? Are they seasonal farm laborers who supplement their income with other sources of income? Are they men or women or both? Are other strategies necessary for meeting the needs of the poor without natural resources versus the poor without money?

Differing opinions exist on the best methods for effectively reaching the poorer smallholders. Some specialists propose that development assistance directed towards the poor should be replaced with a more general production approach accepting the " . . . necessity and the desirability of working with existing power structures and the most progressive and dynamic elements in the rural areas, hoping that over the long term, questions of income inequalities and other problems can be addressed as they emerge" (Morss and Morss, 1982). Attempts to target specific groups for development assistance may irritate donors and recipient governments and possibly lead to impractical projects with few long-term benefits (Morss and Morss, 1982). Another view assumes the failure of the target approach has been the inability to consider adequately the different categories of impoverished groups, the impacts of technology on them, and the suitable assistance programs that meet their articulated needs.

Commonly, agricultural development projects have implicitly assumed the existence of an economically homogeneous "peasantry," overlooking the class and income divisions which divide most rural populations.

> The rural poor, while sharing a common poverty, are comprised of many social groups, differing in occupation, location, sex, status, and religion (Uphoff, et al., 1979).

It seems important that donors and host governments together determine the needs of various poor rural groups. Some groups of rural poor may not even be reached through agricultural development projects and may require other assistance approaches. Uphoff, Cohen, and Goldsmith (1979) and Esman (1978) identify five distinct groups of people in this category who have marginal or no access to land.

1. *Agricultural workers:* landless people who seasonally sell their labor to work on farms.

2. *Non-agricultural workers:* landless who are marginally in the formal economic sector or engage in informal economic activities.

3. *Marginal tenant farmers:* those landless or marginally landless who gain access to land through contractual agreement with other farmers.

4. *Marginal farmers:* those who have title or customary rights to small or marginal farms. These farmers face production constraints due to a lack of water, credit, technology, markets, and good quality land.

5. *Non-sedentary rural households:* nomadic or semi-nomadic pastoralists and other migratory groups who lack recognition of their legitimate land rights and who face increasing natural and economic degradation of their land and water resources. Within this group there are several subgroups characterized by their access to and control of livestock.

Clearly, certain groups face special constraints because of their perceived social status. Women and ethnic minority groups of some countries especially face more severe problems with access to land, credit, suitable technology, and political forums.

Data on the number of landless in Africa are scarce. However, one study provides information which questions the assumption that there is abundant underused land of decent quality. Average figures indicate that 8 to 10 percent of rural Africa is landless and up to 30 percent of the rural population is near-landless (Esman, 1978).

Among the landless, refugees represent probably the poorest class of people in Africa. The exact number of people in this group is very difficult to determine because of their mobility and because famine and civil strife cause constantly shifting environmental, social, and political conditions. Refugee populations in several countries (e.g., Botswana and Somalia) have been settled and are involved in integrated rural development projects. Some settled populations have produced high agricultural returns. In Botswana, for example, two refugee communities have per hectare yields that are higher than contiguous areas (District Agricultural Officer, 1982). However, most refugee populations are composed of pastoralists who are being forced to settle in refugee camps in marginally productive areas and to adapt to a new way of food production. It is unlikely that these groups will be able immediately to produce sufficient food for their own subsistence or for surplus.

Alternative approaches to project assistance might include increased emphasis on integrated rural development, increased levels of funding allocated to "grass roots" organizations, and increased program funding for research. Participants at the OTA workshop were concerned that a target approach toward groups of poor, outside the existing administrative structure, could not alleviate poor people's problems. Therefore, they advocated the more integrated approach to development. Concern exists, though, that the poor will be left out if there are no attempts to integrate them into national, regional, and local planning efforts.

Addressing common constraints of low-resource producers seems necessary. Eicher and Baker (1982) and others have defined "smallholders" to be those farmers who produce on 2 to 10 acres of land, use mostly family labor, till their land with mostly hand tools, and maintain a small capital stock. Esman (1978) adds that these marginal producers face severe constraints to increased food production. OTA's definition of low-resource producers incorporates the above characteristics of Eicher and Baker but adds that low-resource producers are those smallholders and herders who often face major constraints in their access to economic, natural, and technological resources. The farmer must face constraints such as access to reliable productive land, affordable credit, timely inputs, extension advice, draft power, agricultural training, decent producer prices, and seasonable labor. Migratory and semi-nomadic herders face constraints in access to livestock, reliably productive range, veterinary and extension services and management advice, reliable dry season watering points, and technologies on forage crops that will decrease dry season nutritional stress.

The consensus of the OTA workshop was that both African governments and donor agencies need to improve definitions for the target group of low-resource producers, which represents the majority of constrained rural producers; determine the constraints that these producers face and reasonable interventions to overcome them; and ensure that this group is integrated into development program planning. Equally important remains the goal of meeting the needs of those poor who can only marginally be assisted by improved agricultural technologies, identifying ways to generate income and provide basic needs.

Issue 7: Women contribute significantly to food production in Africa, but have limited access to extension services, credit, and training.

Preliminary Findings

- The prevailing model of African agriculture contends that men are the farm managers. However, up to 33 percent of farm managers south of the Sahara are women, and in the remaining households, women do significant farm work.
- Women contribute substantial amounts of labor, capital, and management toward the production of Africa's food. Estimates of women's contribution range from 60 to 80 percent, although regional differences exist.
- In addition to their agricultural contribution, women also do most household chores, such as collecting firewood and water, cooking, repairing and maintaining the compounds, childcare, and marketing surplus garden crops.
- Women are as innovative as their male counterparts in adopting new technologies, yet they receive only a fraction of the services and have fewer contacts with extension staff.
- Women represent only a minute portion of the agricultural extension staffs. Because of cultural norms, male extension workers generally will not consult with women farmers in the household without the presence of an adult male family member, even if the woman is the farm manager.
- Most agricultural training programs for women do not stress agricultural production but tend to be oriented toward home extension.
- Women have little access to formal institutional credit because they usually lack the access to land, livestock, and other forms of collateral.
- Women hold few policy and managerial positions within agricultural ministries, especially those positions relating to animal and crop production, research, and field services.
- Community meetings are traditionally seen as a forum for men to discuss issues affecting the community and for government extension staff to discuss new agricultural strategies and project proposals. Women are almost always excluded from these meetings or are too busy to attend.
- Women ususally are not included in planning projects intended to increase food production.

Discussion

> This one they call 'farmer'; send in teachers to teach him to farm (while I'm out growing the food); lend him money for tractors and tillers (while I'm out growing the food); promise him fortunes if he'd only raise cotton (while I'm out growing the food); buy our land from him to add to your ranches (while I'm out growing the food) . . . No, I daren't stop working . . . and I won't abandon that thing I was born for: to make sure my children have food in their bellies (Taylor, 1984).

African women play a major role in food production. Women's labor and management contribute significantly to food production, with estimates ranging from 60 to 80 percent in many places (Boserup, 1970; Tinker, 1981). These figures may not include women's sizable livestock activities (McDowell, 1984). Furthermore, in most agricultural systems, it is difficult to distinguish between food and cash crops, since many cereal crops qualify as both. Women are expected to contribute work toward the production of cash crops, and their labor provides a significant proportion of the total agricultural component of Gross Domestic Product (GDP). Men, however, are generally the recipients of the income generated. Because of the extremely important role women play in agriculture, a more complete

Photo credit: World Bank Photo by Ray Witlin

African women contribute a substantial amount of the total labor to the production of food crops. Here, Senegalese women harvest sorghum.

knowledge of the constraints women face in agricultural production is necessary. Therefore, it is necessary to understand not only the agricultural responsibilities of women but also the intrahousehold dynamics.

In farming, men and women traditionally assume responsibilities for certain tasks. Social, cultural, economic, and environmental conditions usually are factors in the labor patterns of both rural men and women. Men generally clear, prepare, and plow the land, and women plant, weed, harvest, process, and store the food crops. However, there are many regional variations in this model. It can not automatically be assumed that each household is a self-contained unit with all the household members cooperating and sharing responsibilities and management functions. More appropriately, a woman's role in food production could be considered as semi-autonomous with levels of cooperation among household members differing with each household (Gladwin, et al., 1984).

Cultural differences, demographic and socioeconomic conditions, and labor availability all produce variations in the general model. Some of these include situations where:

1. Some farm operations are shared by the members of the household. The division of labor might be dependent on such factors as seasonal availability and the value of cash crops relative to food crops. The pattern might follow that described above, but women might have to do some of the typically "male" tasks.
2. Women and men of the same household share the responsibility for a common field on which cash crops are grown, but the women produce food crops on separate fields. Presumably, the labor patterns will be similar to the general model, but the man probably will have control of the woman's labor and the cash returns from the crops. The woman usually will provide separate labor and management for the food crop field.
3. Women and men grow separate crops, either on common or on separate fields. For example, groundnuts and beans might be viewed as a woman's crop, while maize is a man's.
4. Women are the household heads and responsible for all the management and most of the labor (Spring, 1984).

The most typical model in pastoral and mixed agricultural systems has men responsible for the care of larger livestock (e.g., cattle) and women responsible for smaller ruminants (goats and sheep). Men are usually entitled to the returns from the sale of cattle and women are responsible for milking and allocation of the milk between the needs of the family and the herd (Hjort and Ostberg, 1978; Spencer, 1973). However, other patterns developed out of expediency include women sharing all livestock responsibilities with men, caring for different types of livestock (e.g., goats and sheep), doing different tasks than men with all the livestock, or taking care of all the livestock (Spring, 1984). Women, generally, cultivate the food crops for family consumption, especially in situations where the men are mostly absent tending herds (Spencer, 1965; Spencer, 1973; Gulliver, 1955).

Women usually handle most of the domestic chores, including the collection of firewood (for cooking) and water often from distant sources, cooking, cleaning, and childcare. A typical rural women's day averages 13 to 15 hours and it is not unusual to see women hoeing with babies strapped to their backs.

Male migration to urban areas in search of employment adds to the burden imposed upon rural African women. With the male absent from the household the women must organize labor for land clearing and plowing and the management of cattle. Women also become *de facto* heads of household and farm managers. As Tinker notes:

> Today between 25 and 33 percent of all households are *de facto* headed by a woman due to divorce, death, desertion, long-term migration, or because she never married. These female headed households constitute the poorest group in every country (Tinker, 1981).

In several countries, the figures are even higher: e.g., Botswana: 40-45 percent (Bond, 1974), Lesotho: 67 percent (Spring, 1984). However, this managerial role has not been recognized and women still are excluded from institutional involvement in agricultural planning, credit for production, access to *de facto* or *de jure* title to land, extension services, and farm production training. Instead, women generally receive traditional training in nutrition, health, home extension, and handicraft production.

Access to extension services is extremely important, but these systems frequently fail to contact women. For many social and political reasons, large amounts of agricultural information and services are directed toward the "progressive" male farmer (Berger, et al., 1984; Roling, et al., 1981). Extension agents are restricted by cultural norms from approaching female heads of household without a man present. They also receive few incentives for approaching women and poorer farmers who lack access to sufficient land and income to purchase agricultural inputs. The assumption is that this information will be disseminated from the "progressive" male farmers to household members and other farmers in the community, but quite often this is not the case (Fortmann, 1978).

In summary, the problems that women face regarding access to agricultural services are:

1. Male planners and extension staff view women as the domestic labor force in the

household who also provide agricultural labor; women are seen as "farmers' wives" (Spring, et al., 1983).

2. Women have few channels for communicating their problems to local leaders or to government agricultural staff.
3. Most research information transferred by agricultural extension staff is aimed at those farmers who have capital for such practices as land clearing and plowing and introduction of mechanical planters, fertilizer, and grain-milling equipment. Usually only men are able to take advantage of these innovations. As a consequence, increased land under cultivation exacerbates the labor burden on women or eliminates some of women's extra income-earning activities.
4. Limited research exists on methods to alleviate the production labor constraints of women (in hoeing, planting, weeding, harvesting, and processing), and few attempts have been made to disseminate information useful to women by institutionalized agricultural extension programs. Women receive fewer visits from extension agents than men do (Fortmann, 1978; Staudt, 1975; Spring, et al., 1983).
5. Women farmers are less likely than men to have sufficient income to purchase necessary agricultural inputs (Berger, et al., 1984).
6. Access to land is necessary for agricultural credit and for membership in most agricultural societies that distribute inputs, information, or technical assistance (Berger, et al., 1984; Moris, 1981; Schumacher, 1981).
7. Even though women tend to be as innovative as men (Fortmann, 1981; Staudt, 1975), seldom are they selected for farmer training courses. When they are, they are often too busy to attend or cannot organize childcare, or attend to find that only home economic courses in nutrition and family welfare are offered.

The OTA workshop participants and other experts find it is extremely important that the constraints rural African women face are addressed. The problems in reaching women are partly political and partly institutional. Political problems such as access to land and participation in the decisionmaking process at the local, district, and national levels could be addressed by African governments if increasing the food contribution of female headed households is a priority. Several possible changes have been proposed that would contribute to assessing the needs of women farmers and provide services that they could use:

1. Recruitment of additional female extension staff. Extension staffs in most African countries are predominantly male. Men make up between 94 and 99.7 percent of the staff in those countries with more than 20 extension agents (Berger, et al., 1984). It is assumed that female extension staff will contact women more frequently than male staff. Therefore, priority could be placed on recruiting more female extension staff.
2. Training courses for all extension staff that explain the role of women in agriculture and that develop techniques designed to encourage the participation of women farmers in the delivery of extension services.
3. Introduction of village level women paraprofessionals to work with women farmers (Ministry of Agriculture, 1983).
4. Incentive systems for extension staff that encourage working with low-resource producers, especially women.
5. Ensure that women have access to credit, either by developing appropriate credit institutions or expanding indigenous credit societies.
6. Design village based programs aimed where women gather—e.g., at village water points.
7. Include women as beneficiaries of land reform or allocate them rights of use to land in traditional systems.
8. Ensure that farmer training courses stressing food production techniques are available to women on an equal basis with men.
9. Emphasize the use of farming systems research (FSR) to investigate the intrahousehold dynamics within farms. For each situation and condition, it is important to identify goals, decision criteria, and the context of the decisions for women (Gladwin, et al., 1984; Spring, 1984).

Photo credit: U.S. Agency for International Development

Many organizations have called for changes in agricultural extension systems to meet the needs of low-resource producers, especially women. One suggestion is to work with groups of people where they normally gather. Village water supplies, like this one in Niger, offer opportunities to reach women without disrupting their work activities.

Issue 8: Extension systems in Africa lack clear objectives and adequate structure for increasing food production.

Preliminary Findings

- Extension systems are in place in most African countries, but generally seem to be ineffective in transferring information between farmers and researchers.
- The objectives of extension programs commonly are confusing to the field staff or the farmers.
- Farmers often have inappropriate expectations of extension.
- African extension systems frequently have few technical innovations to propose to farmers as options to current technology because researchers and the extension service are in different ministries (or divisions) and usually coordinate poorly.
- Extension services generally have few subject specialists who can communicate effectively with both researchers and extension staff.
- Agricultural research and extension services commonly do not take into account the needs of low-resource farmers. Most planning and implementation have been centralized and the innovations introduced tend to be directed toward more "progressive" farmers.
- The U.S. research and extension model assumes that the existing technological base is underproductive and that technological innovations can increase farm productivity.

- The U.S. land grant model of agent/farmer interaction, which uses applied research, could be modified to suit specific country conditions in Africa.

Discussion

One institution directly involved in technology transfer is the agricultural extension service. On a day to day basis, staffs attempt to transfer information on available technologies and farming practices to farmers. The United States and many other donors have spent several billions of dollars on developing and strengthening extension systems (Watts and Claar, 1983). But these attempts have failed to contribute significantly to increases in food production or to reach the poorer segments of agricultural societies (Moris, 1981; Anthony, et al., 1979; Richardson, 1983). Some problems of African extension systems most frequently mentioned are inappropriate models, poorly defined goals and objectives, poor organization, inadequate human and financial resources, lack of suitable technology to extend, failure of agricultural ministries to identify target groups, loss of skilled field staff due to promotion, predominantly male staffs ignoring women producers, and the lack of remuneration, transportation, and respect for the field agents (Kellogg, 1983; McDowell, 1984; Moris, 1981; Spring, 1984).

The historical development of Africa determined the evolution of most extension systems. In Francophone Africa, the French extension model (sometimes combined with the U.S. land grant system) was based on a cash crop economy. The British introduced an extension system in East Africa and parts of West Africa designed to stimulate production of food and cash crops for the British market, even though the domestic British model for extension was based on food production (Watts and Claar, 1983). In each of these areas fragments of these models still remain and affect the objectives of the systems.

The model that the United States has been promoting in many areas of Africa is based on the U.S. land grant system of research, education, and outreach. Using this system, attempts have been made to transfer both international and national research to "progressive" farmers and herders, assuming that the adoption of innovative agricultural techniques will be passed on to other low-resource producers. However, "[developing countries] have systems oriented to serving governmental needs. They stress things, not people. They are not client-centered and not well set up to reach small farmers, to create credibility or to transfer knowledge" (Watts and Claar, 1983).

Five general approaches to agricultural extension exist in Africa. They are: 1) the conventional or innovation-centered approach, based on a package of innovations to be distributed to individual farmers, usually the more "progressive" ones; 2) the commodity-focused approach, based on the promotion of a single cash crop and the inputs necessary for a timely harvest and a suitable remuneration for the producers; 3) community development-cum-extension approach, which integrates agricultural extension with other community development activities; 4) the "animation rurale" or extension techniques used to organize groups of producers to solicit needs and provide information relevant to those needs; and 5) the farmer-focused or the Training and Visit System approach, which emphasizes providing recommendations based on the circumstances of the farmer, regular in-service training for the extension agents, tightly scheduled visits to the farmers, and close supervision (Pickering, 1984).

Problems exist with each of these approaches. The conventional approach generally involves the introduction of relatively expensive technical packages of inputs. Because of the risk involved with the expense of the complete package, it is difficult for low-resource producers to adopt any of these innovations. Consequently, frustrated agents work mostly with the more "progressive" farmers who have the financial means to purchase the packages, and the majority of low-resource producers are excluded. Since the agents work almost exclusively with wealthier farmers or herders, perceived problems that require further attention of research institutes do not represent the problems of low-resource producers (Stavis, 1979).

The commodity approach obviously does little to promote the increased production of food crops as it deals exclusively with the production of a single cash crop. It can be directed toward small holders, but as with the conventional system, the tendency generally requires expensive packages of innovations.

The "animation rurale" approach, by working with groups of producers, has the advantage of reaching more farmers and herders with limited staff. Not only does this allow the extension system to reduce costs but the technique provides a structure for optimizing economies of scale in some farm operations and gives them some control over the extension system (Stavis, 1979). The disadvantage some see is that local groups are difficult to form (Pickering, 1984). However, this problem often can be overcome by working with indigenous groups instead of introducing new ones.

The community development-cum-extension approach is criticized because it diffuses the extension efforts among too many activities and diminishes the impact that extension agents can have on introduction of agricultural technologies (Pickering, 1984). However, enough concern was expressed at the OTA workshop about agricultural development proceeding in a manner isolated from rural development to justify examining this approach.

Finally, the Training and Visit System (TVS) approach represents the World Bank's attempt to strengthen conventional extension systems. Extension agents are being supported with in-service training, closer supervision, and infrastructural support. Also, they are relieved of many of their non-agricultural responsibilities. The system also is designed to ensure that extension supervisors work with a limited number of agents and that the agent/farmer contacts are regularly scheduled (Benor and Harrison, 1977). The system generally uses contact with individual producers but can be used for group extension activities. The advantage of the approach is that it strengthens existing systems and provides regular in-service training. The disadvantages are: 1) it requires a high level of recurrent costs that most African governments cannot afford and 2) by reinforcing existing systems, it may affect little the information flow to low-resource producers, may ignore indigenous production techniques, and may continue to promote technological packages that are inappropriate to local social, environmental, and economic conditions.

OTA has developed several conditions for the successful transfer of technology (Box B). One necessary condition requires that both users and transfer agents be involved in the choosing, planning, and implementation of the technology so that it meets the actual needs of the user. This ensures a two-way educational process; the agent relating technical and institutional support information, and the farmer identifying constraints and needs. Generally, extension agents deliver the message or physical inputs to the community and measure the outputs. This organizational structure allows no opportunity for feedback from farmers to reach the researchers and assumes that the government agricultural hierarchy knows what is best for the farmers (Nobe, 1983; Moris, 1981).

Another equally important condition is that the technology be adapted to the users' local biophysical and socioeconomic situations. This implies that extension systems not only have to introduce technologies that fit the local conditions but also must be sensitive to the existing farming systems and indigenous technologies. The extension system should be able to transfer information in both directions. The farmers' problems need to be presented to agricultural researchers and policy staff, while the researchers need to present suggested improvements back to the farmers.

To reach low-resource producers effectively and increase food production, African governments and donor agencies must establish clear objectives for agricultural development, target group(s), and alternative structures for agricultural extension systems that assist in meeting objectives. An effective extension system should: 1) provide mechanisms for research/extension coordination, 2) establish clear terms of reference that rural people understand and support, 3) develop methods for understanding the constraints of and providing opportunities for low-resource producers, 4) identify indigenous agricultural technologies and determine their effectiveness, and 5) function on the premise that client participation is crucial.

Box B.—Conditions Necessary for Successful Technology Transfer

The OTA assessment on technologies to sustain tropical forest resources identified a number of necessary conditions for successful technology transfer. For most technologies, the lack of these conditions seems to be constraining wider adaptation and adoption:

- Technology is transferred most effectively by direct people-to-people actions. People who are to adapt and apply the technology need to learn it directly from people who have experience applying it.
- The technology needs to be adapted at the user's end to local biophysical and socioeconomic conditions.
- Well-qualified people with knowledge about the technology are needed on the source end of the transfer, and receptive, capable people are needed on the receiving end. These people may be local transfer agents or they may be the end users.
- Another type of actor, the "facilitator," is also necessary. Facilitators understand the technology transfer process, including the market for the technology and its products and the political, social, and economic constraints and opportunities that affect all the other actors.
- Users and transfer agents should be involved in choosing the technologies and in planning and implementing the transfer process so that the technology and the transfer meet actual needs and are appropriate for the local situation.
- All parties involved—source, transfer agents, facilitators, and end users—must feel that they are winners and must, in fact, be winners. Each actor's self interests should be identified at the start of the technology transfer process so that they can be addressed.
- Each participant must be aware of subsequent steps in the transfer process so his or her actions are appropriate to the late steps. This requires early definition of roles for each person involved.
- The environment for technology demonstrations should be similar to the environment that will exist during subsequent steps of the transfer process. Pilot transfer projects should not be unrealistically easy.
- The initial commitment of resources to the process should be sufficient to carry the technology transfer until it is self-supporting.
- The transfer process must include mechanisms through which all participants can contribute effectively to interim evaluations and improvements.

SOURCE: U.S. Congress, Office of Technology Assessment, *Technologies to Sustain Tropical Forest Resources, Summary* (Washington, DC: U.S. Government Printing Office, March 1984).

> [T]he fundamental problem lies not, as is commonly assumed, between researchers and extensionists . . . much more serious was a failure by both research and extension to perceive farmers' problems from the farmer's own perspective . . . . If research and extension are to offer useful recommendations to farmers, they must look at the whole farming system (Collinson, 1984).

A farming systems research (FSR) approach provides a methodology that has promise. Farming systems research is "an approach to agricultural research and development [of technology] that views the whole farm as a system" (Shaner, et al., 1982). The primary goal of FSR is to increase the productivity of the farming system given the complete range of societal goals and the constraints of the farming systems (Gilbert, et al., 1980). Characteristics of FSR include: 1) location-specific research, 2) development of improved technologies for a target group of farmers, 3) an interdisciplinary nature, 4) an iterative approach to technology development, 5) using the house-

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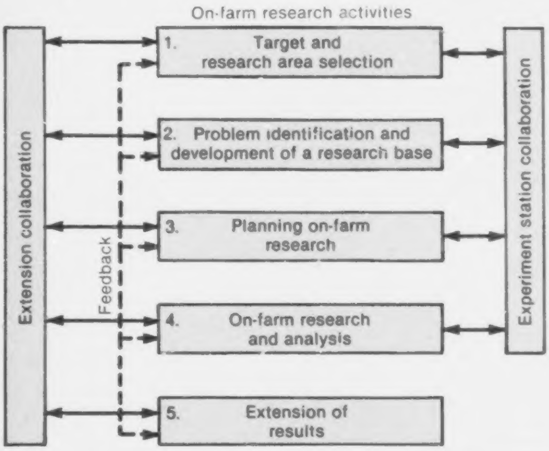
hold as the management unit, and 6) farmer participation in the research development (CIMMYT Economics Staff, 1984; Shaner, 1983).

Figure 9 indicates this step-wise technological transfer process with sufficient feedback provisions to ensure the development of technologies appropriate to farmers' needs. OTA workshop participants felt that FSR could be a very useful method for determining farmers' constraints and developing technologies *with* the farmers (on their fields) instead of *for* them. However, since AID is questioning the cost-effectiveness of the approach, the OTA workshop participants felt that the approach needs to be simplified and needs to incorporate conventional extension systems in the process.

Agricultural extension remains ineffective in the identification of farmers' constraints and in supplying useful technology in response to these constraints. African governments could develop concise objectives that stress the need for farmer participation, coordination between researchers and extension, and alternative approaches for dealing with low-resource producers. However, even with more effective extension systems, one thing should be emphasized.

Figure 9.—Integrating Farming Systems Research and Agricultural Extension for Technology Transfer


On-farm research activities
Extension collaboration
Feedback
Experiment station collaboration
1. Target and research area selection
2. Problem identification and development of a research base
3. Planning on-farm research
4. On-farm research and analysis
5. Extension of results

SOURCE: Willis W. Shaner, "Linking Extension with Farming Systems Research," In: *Knowledge Transfer in Developing Countries*, J. B. Claar and L. H. Watts (eds.), Proceedings of a Conference on International Extension, Steamboat Springs, CO, July 1983.

> [E]xtension programs by themselves in the absence of land tenure reforms and vigorous, egalitarian input supply programs, should not be expected to reverse the trend toward concentration of assets in the rural society, or to save the small, poor, or inefficient farmer. They can, however, assure that the small farmer is not disadvantaged with regard to information (Stavis, 1979).

Issue 9: The lack of training and back-up support for extension field staff contributes to inadequate information transfer.

Preliminary Findings

- Physical constraints affecting extension agents have been lack of transportation, decent housing, in-service training, access to information, and remuneration/incentives for working in rural areas with few services.
- Extension agents sometimes act as input distributors instead of information disseminators.
- Field agents have been burdened with a substantial number of nonagriculturally related activities that limit extension work.
- The agent/farmer ratio remains low in most countries, which encourages a "progressive" farmer approach instead of a broader group approach.
- Inadequate numbers of well-trained field staff is a problem. The recruitment of field staff usually is biased toward urban residents with little farm experience. Excellent staff are promoted out of the field; no incentives are offered to continue working in rural areas.
- Overemphasis is placed on paper work instead of field accomplishments.
- Agricultural training institutes generally have taught extension staff individual farmer intervention techniques. Group extension activities usually are given low priority.
- In-service training is limited and does not provide opportunities for staff to provide feedback to trainers.

Discussion

Extension services, as with most institutions in Africa, suffer from weak human resources devel-

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opment. Depending on the area, a typical extension agent is expected to communicate with between 100 and 800 farm families (Anthony, et al., 1979; Pickering, 1984). In addition, the agent also will have several nonagriculturally related tasks to accomplish. These include attending monthly agricultural meetings that may require several days of travel time, distributing agricultural inputs, monitoring credit collection, settling local disputes between farmers, and serving as a local government agricultural representative (Watts and Claar, 1983). These impositions on the staff serve to limit motivation. Most extension agents live in fairly remote areas, lack adequate housing and transportation, receive low salaries compared with urban counterparts, are given inadequate technical information and moral support, receive little in-service training, and perceive limited potential for career advancement (Moris, 1981; Hyden, 1983; Watts and Claar, 1983).

As a result of the extended network and lack of support, an extension agent generally responds in at least two detrimental ways. One is that the

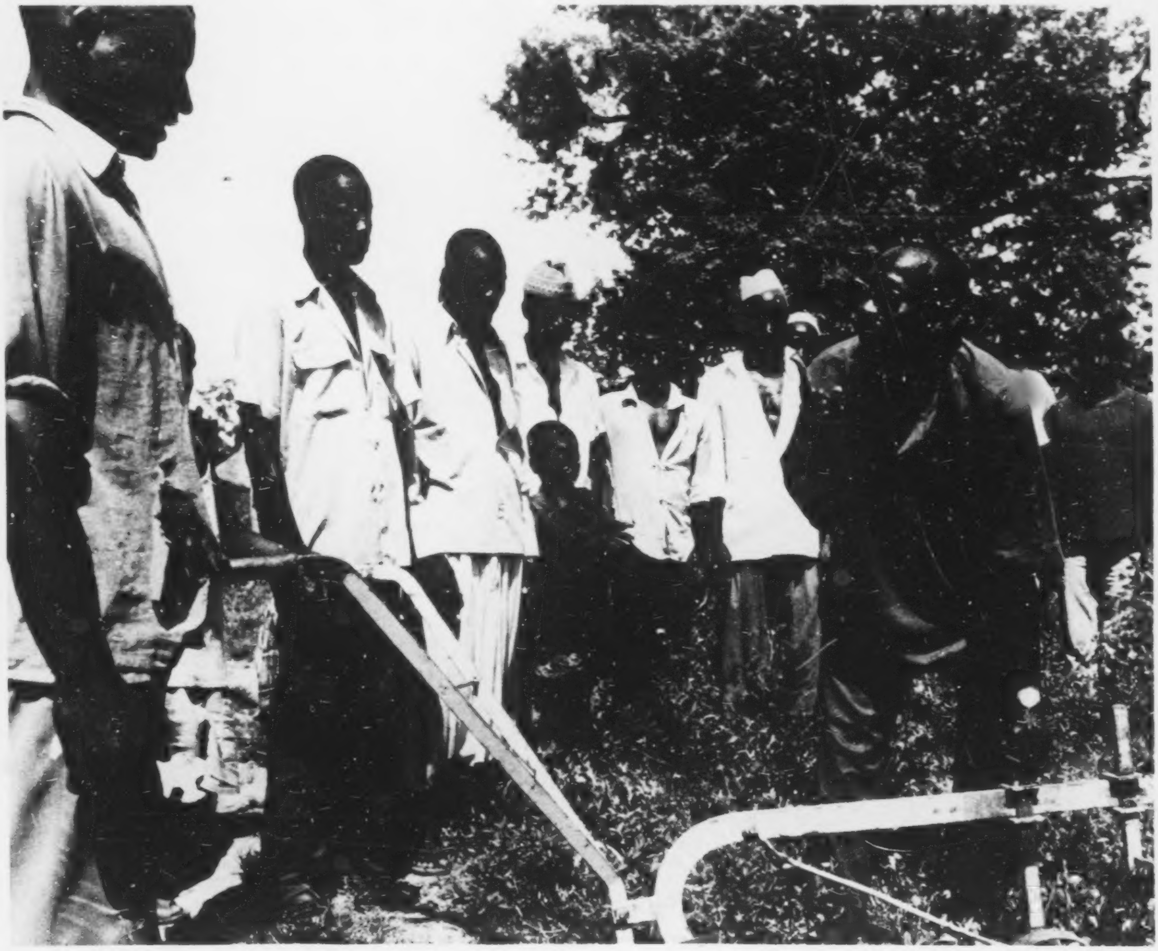

Photo credit: Ray Witlin of the World Bank

Agricultural extension systems are generally weak and offer few incentives for staff to work in the more remote areas with low-resource producers, especially women. Here, an agricultural demonstrator shows male farmers of the Casamance region of Senegal how to use a single-furrow plow.

agent realizes the physical constraints (and the lack of incentives to operate otherwise) and limits the number of field visits to those farmers who are either immediately accessible or "progressive" enough to more readily accept government advice and/or inputs. The agent will also attend community meetings where contact with a larger body of farmers is possible. The other response is that a growing emphasis is placed on quantification of inputs and outputs to justify the extension agent's existence. The agent then becomes a distributor of inputs, not an extension agent. Neither one of these responses results in an extension agent who communicates with target groups of farmers or who is an active disseminator of technology based on perceived and/or articulated farmers' problems.

In the past several years, the World Bank initiated an extension support program that was designed to eliminate some of these problems. The program, called the Training and Visit System (TVS), strengthens the extension system by separating it from other conflicting responsibilities and through credibility-building support programs. Moris (1981) identifies other reform measures of the TVS as: assignment of a reasonable number of farm families to each agent, providing reasonable supervisor/agent ratios, identification of innovations that will have an immediate impact, intensive in-service training on a scheduled basis, provision of methods for the improvement of farm management before encouraging purchased inputs, developing contact links with research bodies, and providing sufficient transport and incentives for the contact staff.

The TVS deals with the credibility, institutional weakness, and incentive issues. Criticisms of the system are that: 1) it is based on the false assumption that exogenous technologies exist that are suitable for local ecological, social, and economical conditions, 2) it requires large recurrent budgets to operate, and 3) it does little to eliminate the male bias in extension systems. However, as others have indicated, the TVS does a great deal to strengthen the inadequate human resources component of extension systems. It could be evaluated further to determine its role in upgrading existing extension systems, especially with respect to FSR.

Chapter 5

Issues in Technical Assistance

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Issues in Technical Assistance

Technology development and technology transfer are of course key to American efforts to increase food production in Africa. But the effectiveness of these efforts depends in large part on the effectiveness of technical assistance programs. That leaves a major question: is it possible to determine if assistance—whether through public or private channels—is working?

This section discusses issues relating to the effectiveness of technical assistance, some directed at U.S. Government policies and others at nongovernmental organizations and private businesses. For instance, how are assistance efforts hindered by the lack of clear U.S. goals and lack of long-term U.S. commitment to development? Are the impacts of large amounts of aid proportionately effective? How can assistance programs be evaluated to determine if they were successful? And what roles can private businesses and nongovernmental organizations be expected to play in increasing food production?

Issue 10: U.S. foreign aid to Africa operates without clear goals and objectives and without a long-term commitment to development.

Preliminary Findings

- Foreign aid benefits the United States substantially, both economically and politically, but this has not been made clear to the American public. Therefore, development assistance remains controversial, with little constituency for reform.
- Increasing agricultural production, as well as food security, in sub-Saharan Africa requires a long-term commitment to development with continued technical support and assured funding.
- Long-term technical assistance is difficult to provide under the short-term political conditions common to American foreign assistance.
- Development priorities and initiatives shift from administration to administration as foreign policy goals and AID staff change.
- Countries' eligibility for technical assistance changes, sometimes frequently, as a result of internal and external political changes.
- Administration policies may conflict with previously legislated goals; competition between old and new initiatives and thus staff confusion may result.
- Foreign aid projects usually are too short to have long-term, positive impacts on the difficult agricultural problems in sub-Saharan Africa.
- The trend in length of projects conducted by AID cannot be determined because of problems with the data base.

Discussion

American foreign aid provides substantial benefits to the United States. For this reason, it has received the strong support of every administration since World War II.

Congress has been less steadfast in its support of U.S. foreign aid. Historically, U.S. security and political benefits have been regarded as the most important ones. Some Members recognize that large amounts of U.S. foreign aid money return to the United States as purchases of U.S. goods and services. In fact, procurement policies ensure that most foreign aid funds are spent in the United States. Therefore, foreign aid has economic benefits at home *and* overseas. Other Members of Congress have advocated foreign aid on humanitarian grounds.

Still other Members of Congress can be described as:

- advocates of particular development strategies—e.g., women in development;
- supporters of new approaches—e.g., the African Development Foundation;
- uninterested parties because the foreign aid budget item is relatively small; and
- committed adversaries on the grounds that foreign aid is a bad investment, harming the

United States and the recipients (Morss and Morss, 1982).

The American public, as a whole, is not an enthusiastic or reliable supporter of foreign aid. Less support exists for foreign aid than any other type of Federal spending according to recent Louis Harris surveys (Morss and Morss, 1982).

The diversity of congressional interests, the lack of a strong public constituency, and most Presidents' disinterest in the specifics of foreign aid bills have led to "grab-bag" legislation. Currently, AID development projects must meet some 75 legislative and statutory requirements before approval (Commission on Security and Economic Assistance, 1983). In addition, Congress has demonstrated a wide array of concerns during reviews of U.S. foreign aid, "concerns that frequently have little to do with the congressional intent reflected in its own aid legislation" (Morss and Morss, 1982). In recent years so little congressional interest has existed that it was difficult to enact foreign aid authorization and appropriation bills (Nowels, 1984).

U.S. foreign assistance programs that have emerged from these considerations are designed to: 1) promote support for humanitarian relief efforts, 2) foster export expansion, 3) enhance a stable international economy, 4) expand support from other Western donors through multilateral institutions, 5) support regional peace initiatives, 6) provide security for friendly governments, and 7) counter Soviet and Soviet-supported influence. These goals sometimes are not compatible nor are they generally translated into measurable objectives in set time frames. In addition, their relative priorities and relative effectiveness are open to varying interpretations (Wilhelm, 1983).

U.S. foreign aid is now near an all-time-low level as measured in percentage of gross national product and constant dollars. The proportion of bilateral development funding aimed at Africa has decreased recently, but other programs for Africa have increased due to larger emergency food deliveries under Public Law 480 and proposals for new programs (Nowels, 1984). In 1983, the Secretary of State established a bipartisan commission to conduct a comprehensive review of the goals and objectives of American programs and to identify ways to increase support for them. The Carlucci Commission concluded that:

> In Africa there is an economic crisis of major dimensions that will call for a serious long-term response by the U.S., the donor, and the recipient countries. Failure to deal with these problems can have serious security implications (Commission on Security and Economic Assistance, 1983).

The Commission also suggested that the United States:

- increase foreign aid funding;
- expand support for foreign aid among Federal leaders and the public;
- use aid to support economic policy reforms and promote the private sector;
- increase concessionality of military aid;
- increase flexibility in aid;
- establish a new Federal agency to coordinate and administer foreign aid programs;
- adopt a country approach to aid;
- increase emphasis on science and technology, human resources development, and institution-building;
- support development objectives of the Food for Peace Program;
- ensure integrated programs for sub-Saharan Africa and the Caribbean Region; and
- improve evaluation of bilateral and multilateral programs (Commission on Security and Economic Assistance, 1983).

The proposed Federal agency was the Commission's recommendation for dealing with the fragmented nature of foreign assistance programs. It reflects Commission members' perceptions that all forms of foreign assistance need to be integrated into programs in which funding levels, related activities, and degree of concessionality are based on both the recipients' needs and U.S. objectives (Wilhelm, 1983). This proposed agency has not been established, although some of the Commission's other recommendations have been implemented.

The Agency for International Development (AID) is charged with implementing most U.S. bilateral foreign aid policies. The congressional mandates in 1973 known as "New Directions" introduced new concerns into the design of AID programs (Morss and Morss, 1982). Interpretation of the legislation has been difficult, with AID favoring projects with visible short-term effects rather than long-term projects with less immediate benefits (Stokeld, 1982). In addition, short-term shifts in the proportion of assistance designated for military, economic security, and development programs occur and are controversial (Nowels, 1984; Commission on Security and Economic Assistance, 1983).

The eligibility of particular countries for foreign assistance changes with political changes in the United States and in the host country. For example, assistance to Tanzania and Ethiopia was affected by shifts to socialist policies in these countries, despite the avowed humanitarian purposes of some assistance. This problem is likely to increase as the U.S. Government funds larger portions of the private and voluntary organizations' budgets. Their ability to respond to humanitarian needs for agricultural assistance may be decreased by their closer ties to U.S. foreign policy.

The effects of such policy shifts on technology can sometimes be direct. For example, Congress enacted section 107 of the International Development and Food Assistance Act of 1975, authorizing AID to expand its efforts with capital-saving technology. AID has emphasized private sector initiatives since that time and some AID staff perceive that the two efforts conflict (U.S. GAO, 1984).

Agriculture is the central focus of much American aid to Africa, reflecting a wide consensus inside and outside of the American Government that agricultural development is the most important long-term concern for the entire African continent (Whitaker, 1984). AID allocates about 60 percent of its African assistance to agriculture, or approximately $150 million in fiscal year 1985 (U.S. Congress, Committee on Appropriations, 1984). Debate continues whether development assistance to Africa remains too low or is poorly balanced with other types of assistance.

The U.S. Government has struggled to determine the most effective type of rural development aid for decades (Ruttan, 1982; 1983). Community development was emphasized in the 1950s. In the 1960s, donors supported narrower agricultural production programs and institution-building. "Integrated rural development" was popular in the early 1970s, only to be replaced by the "basic needs" approach in 1973. Now the "basic needs" approach is being severely questioned. The number of families whose most basic needs are not met continues to grow (Ruttan, World Development 12(4), 1984) and, especially in Africa, reliable food surpluses do not exist (Eicher and Baker, 1982).

Finding an appropriate niche for American involvement is essential, given a limited foreign aid budget and continuing severe food problems (Falcon, 1984). The Carlucci Commission notes that the United States is virtually alone among bilateral donors in supporting projects developed by resident staff. Critics claim that this approach leads to fragmentation. For example, AID supports approximately 1,000 projects in Africa now (Eicher, October 1984). Suggestions for new approaches include:

- greater multilateral coordination with individual donors assuming responsibility for aid to certain regions of the world or sectors of activity; and
- greater emphasis on general long-term program aid instead of specific project aid, especially in agricultural research.

Issue 11: The evaluation process used by AID does not enable a consistent determination of the effectiveness of the Agency in providing technologies to low-resource producers.

Preliminary Findings

- AID evaluations prior to 1980 measured project inputs and outputs and were weak on any kind of qualitative or quantitative information regarding other types of positive outcomes of the AID projects.

- AID's Africa Bureau developed guidelines in 1982 for evaluating the rate of technology adoption for its projects. The guidelines have not been used consistently and AID plans to discontinue them.

- Too much attention is paid to starting new projects and not enough to implementing and evaluating existing ones.

- The problem at AID missions is part attitudinal and part staffing; most missions have too many obligations for the size of their staffs.
- Evaluation reports commonly are not taken seriously by the mission directors. They apparently consider evaluation a peripheral activity, do not have full-time evaluation officers, and see little value in using evaluations in the design stage of new projects.
- Host country counterparts usually do not participate in the evaluation process because the process is seen as being negative and they do not wish to be involved in a process that may influence their own standing in the government.
- Intended beneficiaries of projects are seldom included in the evaluation process. This participation could assist project implementors in determining socioeconomic impacts.
- Duration of projects is too short to measure results effectively and establish continuity; feedback is needed during the life of the project.
- AID handbooks require that AID missions use past project experience in designing new projects. However, this guidance is not consistently followed or enforced by AID.
- African ministry planners and beneficiaries are seldom involved in the evaluation and design phases of AID projects.
- In-service training of AID mission staff may not include guidelines on evaluation procedures and the importance of feedback planning.

Discussion

AID's effectiveness in transferring technology appropriate to increasing food production by low-resource producers in Africa can be measured by its own project evaluations. Any agency involved in project design and implementation must be able to learn constructive lessons from past performance to improve ongoing and future project design. Through interviews and other research, OTA examined the AID evaluation process.

Stressing field autonomy, the AID missions determine which projects in their respective portfolios require mid-term and final evaluations. The projects selected represent the development emphasis of the mission's Country Development Strategy Statement (CDSS). For example, a mission concentrating a substantial portion of its budget on FSR would presumably want to identify a larger number of its FSR projects for evaluation.

The Africa Bureau of AID/Washington receives 2-year evaluation plans of each mission. The Bureau identifies larger issue areas for evaluation and determines if the composite evaluation plans from each mission will gather the necessary information. If not, the Bureau requests additional information or conducts its own evaluation to gather the necessary information. The Bureau then approves the respective mission plans for the review of the Center for Development Information and Evaluation (CDIE).

The CDIE oversees AID's evaluation process. This center reviews mission evaluation plans and the Africa Bureau, conducts assessments (impact evaluations on selected topics), and provides information on development theory, past AID projects, and technical data through its development information system.

In 1979, AID re-established its Africa Bureau evaluation unit. Its evaluation officer requested a study by the U.S. Department of Commerce Census Bureau on the effectiveness of the AID evaluation process regarding its appropriate technology projects. The Census Bureau concluded that AID missions did not use project evaluations because the evaluations contained little information for subsequent project design. Specifically, "technology transfer for the purpose of the project was not defined, adoption was not defined, the variables needed for monitoring adoption were not identified and the degree to which technology existed prior to project implementation had not been measured" (U.S. Department of Commerce, 1983). A separate report also concluded that the AID evaluation process produced no comparative or consistent data with which to compare projects within the AID portfolio (Associates in Rural Development, 1982). Finally, an AID-commissioned impact assessment concluded that the absence of information on project characteristics makes a comparative analysis of AID's projects difficult (Crawford and Barclay, 1982). However, a more fundamental question remains on the value of the original project goals and objectives. Crawford and Barclay (1982) identified some of the major problems with evaluating the effectiveness and goals of AID in conducting research for small farmers.

> [T]here [is no] guarantee that the original project objectives are realistic and can themselves serve as an adequate basis for evaluating project performance. Project goals and purposes are sometimes written to guide the authorization of project funds rather than to guide project evaluation. The majority of sample projects, at least nominally, concentrated on research whose ultimate goal was to benefit small farmers. Generally, the projects concentrated on crops that small farmers grew or worked in resource poor areas where small farmers and the rural poor comprise most of the population. Except to note that this was the project goal, however, evaluations gave little attention to measuring the success of such efforts or evaluating alternative methods of reaching the smallscale farmer (Crawford and Barclay, 1982).

In an attempt to develop procedures that AID could use to collect uniform data for project comparison, the Census Bureau proposed 11 guidelines that all evaluations were to address. The guidelines contained categories for the measurement of those constraints the project attempted to overcome, technologies introduced and replaced, justification for the assumptions that the beneficiaries would adopt the technologies, post-project adoption rates, the type of technology transfer system, and the impact on the intended beneficiaries. The guidelines were approved for use by the Africa Bureau in March 1982.

Recent OTA interviews with AID officials indicate that AID has not consistently used the guidelines and feels that the guidelines should be discontinued. In their place, AID will propose that evaluations outline some general problems so that common concerns and experiences can be compiled for use by project design personnel. However, this approach may not provide comparative data to determine the impacts of projects upon intended beneficiaries or excluded groups, especially women.

OTA finds that sufficient evidence exists to indicate that at present the AID evaluation process serves little purpose in assisting project design officers and certainly gives little comparative information of the impact of AID's projects upon the rural poor. AID's efforts to strenghten its evaluation capacity could be strongly supported. Within Congress, AID, and host country ministries, the evaluation process could be seen in a more positive perspective. An audit process is less effective than one that encourages the use of qualitative and quantitative information for improved project design. However, AID could do much more to ensure that the beneficial or adverse impacts upon groups of rural poor are measured. The most beneficial change would be to involve host country planners and project beneficiaries in the evaluation process in a manner that allows objective criticism of projects without punitive responses from the government or AID.

Issue 12: The results of recipient countries receiving large quantities of concessional food aid are not clear.

Preliminary Findings

- Food aid is an important type of development assistance. The need for food aid in Africa will persist because of constraints on agricultural production in drought-prone and other areas.
- The impacts of concessional food aid sometimes are negative; food aid can displace indigenous farmers from the marketplace, shift dietary preferences, decrease incentives for increasing local food production, and discourage recipient governments from undertaking needed agricultural reform.
- Goals of donor and recipient countries, and long-term versus short-term interests of each, may conflict when donors provide large amounts of food aid regularly. For example, arguments exist whether commodity benefits have been achieved along with development benefits in the Public Law 480 programs.
- Development programs may be forced to compete with food aid programs, given the downward trend in overall foreign assistance.

- Certain U.S. States benefit substantially from sales of Public Law 480 commodities. Experts disagree regarding the current and future importance of Public Law 480 in disposal of U.S. surpluses.

Discussion

In 1984, the U.S. celebrated the 30th anniversary of its primary food aid program, Food for Peace (the Agricultural Trade Development and Assistance Act of 1954, Public Law 480). Amendments during its three decades have shifted the program from local currencies to dollars, deleted references to the use of American surpluses, and tied food aid to development assistance and policy reform in recipient countries.

Public Law 480 has three components as a result of these amendments. Title I provides favorable terms for financing private sales of commodities to "friendly" countries. Title II authorizes emergency donations handled by international agencies and U.S. private and voluntary groups. Title III provides food for resale and then local use of the proceeds for approved projects or policy initiatives (USDA, July 1984a).

The total African Public Law 480 program in fiscal year 1984 was estimated at $258.9 million with about one-fifth of that amount supplied as emergency food aid. AID proposed that the program for fiscal year 1985 be funded at $234.7 million, without including estimates of emergency needs (U.S. Congress, Committee on Appropriations, 1984). The current famine has accelerated shipments of Public Law 480 commodities; allocations approved in the first month of fiscal year 1985 are approximately 75 percent of total shipments in fiscal year 1984 (Cook, 1984). Food aid is expected to be a continuing need in Africa, especially in the areas where climate fluctuates widely and more droughts are probable.

This program has been an important source of emergency food aid for African countries. Also, Public Law 480 benefits the United States substantially: 12 American States each sell approximately $50 million of agricultural products annually; most other States sell smaller amounts (USDA, July 1984a). Doubts exist, however, about its long-term effects on agricultural development and whether it is the best method to achieve sometimes conflicting goals. Despite repeated attempts to evaluate Public Law 480's effects on individual countries, the program continues to face charges that:

> Public Law 480's main beneficiaries are American farmers and the U.S. merchant marine. Public Law 480 has bankrupted poor farmers, encouraged the welfare ethic in recipient countries and squandered billions of tax dollars (Bovard, 1984).

Food aid never constitutes a lasting solution to problems of hunger and food production. It may save lives in emergencies but even then donors might not anticipate needs or make deliveries in a timely fashion. Large quantities may strain the capacity of recipient countries to store and distribute products efficiently (Matzke, 1984; Okigbo, 1982).

Other fundamental questions about food aid are asked. Critics charge that food aid prolongs dependence and hampers efforts to increase food production in recipient countries. The main dangers are:

- encouraging postponement of overdue agricultural reforms in recipient countries, thus creating artificial food "emergencies" and detracting from the effectiveness of agricultural development assistance;
- making domestic markets unpredictable and discouraging local producers from increasing production;
- shifting dietary preferences to wheat accelerates demands for that grain. Many African countries cannot produce wheat for climatic reasons and thus may become permanently dependent on imports; and
- not reaching the people in most need nutritionally (Clay and Singer, 1982; Matzke, 1984).

No consensus exists on these broad questions. But Clay and Singer (1982) note that widespread criticism of Public Law 480 has been replaced by more ambivalent views of its potential positive and negative effects.

The General Accounting Office has investigated many aspects of this program, publishing 28 reports from 1976 to early 1984. Their findings include:

Photo credit: F. Botts of United Nations/FAO

The role of food aid continues to be controversial. As an emergency measure, it is crucial during times of drought and famine. However, the long-term effects may produce disincentives to increased food production. Here, Burkina Faso villagers collect emergency food aid during the Sahelian drought of 1973.

- U.S. costs could be cut by more timely collection of local currencies, altering cargo preference laws, and shipping with long-term country and regional requirements in mind;
- limited attempts to use Title III for agricultural reform are unsuccessful and constrained by U.S. and recipient country administrative problems;
- Public Law 480 funds could be used in innovative ways—e.g., for developing irrigation projects;
- closer watch should be kept on equitable distribution of aid to refugees, monitoring and auditing of commodity transport, and the programs in certain countries; and
- AID needs to document that food aid does not increase disincentives to local food production and that sales under Title I help the poor.

Title III, the Food for Development section, is intended to contribute to long-term agricultural gains in sub-Saharan Africa. Its multi-year agreements are unique in Public Law 480 programs. To the extent that these funds are used for agricultural projects, agricultural technology will play an important role in the program. The role of projects versus policy planning has been the subject of considerable debate within the program, however. The Office of Management and Budget has been a major advocate of decreasing project spending, sometimes at odds with the U.S. Department of Agriculture and U.S. AID (Garzon, 1984). Criticisms are made that projects are poorly formulated. They are not commonly oriented to technologies suitable for low-resource producers.

The number of countries that take part in Title III programs is small: only six agreements were signed in its first 4 years; two of these were in sub-Saharan Africa (Senegal and Sudan). Other potential recipients in Africa "are unable to sign agreements because of internal instability, political differences with the USA or reasons of political ideology" (Garzon, 1984). Since 1981 when Garzon completed his analysis, the number of countries signing Title III agreements has declined and GAO questions the merits of continuing the program.

Issue 13: Private voluntary and nongovernmental organizations (PVOs) may have particularly useful roles in African agricultural development, but these are neither clear nor constant.

Preliminary Findings

- PVOs have played a major part in U.S. development assistance, first by providing humanitarian, then social and economic development aid.
- Often their work with technology has been limited due to lack of interest and expertise and a low level of technical back-up, but this is changing.
- The roles of PVOs are shifting as government funds supplement private contributions.
- These shifts may require that more attention be paid to identifying PVOs' particular strengths and to designing, managing, and evaluating projects with these strengths in mind.

Discussion

Many PVOs played an important historical role in Africa. The provision of social services, including emergency food relief, new schools, roads, and irrigation facilities, has been an important and successful role for many. For example, "a study covering the 1969 to 1973 period found that church organizations provided about 20 percent of the total hospital and maternity beds in all Africa" (Tendler, 1982). These programs may have had small overall impacts on development but their local impacts appear to be significant (Sommer, 1977).

In the past 20 years many PVOs shifted their work from disaster and food relief toward development assistance. This shift can be attributed both to the PVOs' assessments of the roots of poverty and to AID's congressionally mandated attempts to bring PVOs into the development process. Now AID provides PVOs with several hundred million dollars annually. Twelve to sixteen percent of AID's development and disaster assistance funding is available to PVOs due to 1981 congressional action (U.S. AID, May 1982a).

Private voluntary organizations are diverse. They vary in size, budget, ideology, degree of specialization and expertise, use of volunteers, age, program content, structure, and style of operation. The large disaster and development groups, such as CARE and Catholic Relief Services, generally have large budgets and close ties to the U.S. Government. Often the religious PVOs generally are smaller, but have large numbers of people located in villages. For example, about 8,450 American missionaries work in Africa (Hayden, 1984). Humanitarian groups, like religious PVOs, mainly rely on private contributions. A distinct set of these organizations focuses specifically on technical assistance—e.g., Volunteers in Technical Assistance (VITA) and Technoserve. In addition, individual PVOs are joined in various permanent and temporary coalitions.

While these differences make generalization difficult, PVOs commonly perceive themselves as a community with common characteristics. One set of features that many American PVOs claim to share is: the lack of public appreciation for their work in developing countries and consequent problems with fund-raising, the predominance of U.S. Government influence, the nature of their leadership, and the difficulties inherent in operating overseas programs (Biddle, 1984).

Another set of characteristics allegedly describes the way PVOs work. These features are accepted inside and outside of the community to such an extent that Tendler (1982) describes them as "articles of faith" (table 5; see also Hyden, 1983). The people who accept these articles advocate an expanded role for PVOs in American development

Table 5.—The Role of Private Voluntary Organizations (PVOs): Articles of Faith

Theme	Assumptions of PVOs
Reaching the poor	• long experience working with the poor
Participation	• include poor beneficiaries in decisionmaking process
Process v. outcome	• interested in long-term process, not execution of specific tasks • function to establish process for poor people to gain control of lives • not interested in output measures of traditional evaluations
The public sector	• deal "people-to-people," not government-to-government • do not channel money through the public sector
Flexibility, experimentation	• can be flexible and experimental because they are small, not in the public sector, and do not have to show fast results
Local institutions	• have special ability to work with and strengthen local, private institutions
Cost	• can benefit the poor at lesser cost than large public sector organizations

SOURCE: Adapted from: Judith Tendler, *Turning Private Voluntary Organizations into Development Agencies: Questions for Evaluation*, U.S. AID Program Evaluation Paper No. 12 (Washington, DC: U.S. AID, April 1982).

assistance. Most aid recipients appear to agree that PVO aid is flexible, honest, prompt, coordinated with other efforts, available to needy and remote areas, and open to experimentation (Sommer, 1977). Critics note, however, that PVOs do not necessarily exhibit such features as flexibility and continuity. Therefore, the degree to which these features are accurate is important in considering the future role of PVOs in development assistance.

Problems in evaluation have hindered a clear understanding of what PVOs do well and what they do uniquely. Evaluations of PVO work have been a continuing concern of donors, and the cohesiveness of the PVO community is illustrated by its collective lack of enthusiasm in responding to these concerns. Often external evaluations are feared because of their potential for diverting efforts from "important" activities, because they represent an outside intrusion, because they may affect the organization negatively, or because they are perceived to be highly political (Tendler, 1982). The 1973 Foreign Assistance Act began the trend to regular evaluation. As AID made more money available to PVOs, it also required greater accountability. Difficulties persist in measuring project significance versus operational performance and in including intended beneficiaries in the evaluation process (Sommer, 1977).

Relations between governments and PVOs have changed as governments have come to rely more upon them. PVOs often maintain an adversarial rhetoric about their advantages over government assistance and their need for independence. In fact, however, the operations of many groups have become closely tied to government aid in various ways. Some of the larger relief organizations receive nearly 80 percent of their funds from the U.S. Government (Sommer, 1977).

Government/PVO relations also take other forms. In some cases, PVOs serve as innovators from which governments learn and replicate projects. This role seems less common than PVOs contend, however, and perhaps is limited to new PVOs in early stages of growth. In other cases, PVOs serve as precursors to governments, filling a need until governments are able or willing to address the same problems. PVO/government relations can be categorized more generally and completely as complementary, filling unoccupied territory, competitive, brokering, replicating, or government takeover (Tendler, 1982).

Many of these relations are replete with ambivalence. Some PVOs refuse all government funds to avoid: 1) compromising their programs, 2) appearing to be linked to official U.S. Government policy, and 3) accepting government planning and evaluation methods.

PVO involvement in agriculture has increased recently. For example, several groups made particular contributions in bringing "Green Revolution" technology to the poor (Sommer, 1977).

Box C.—Is The Peace Corps a PVO?

The Peace Corps is an anomaly among development assistance groups. It is an independent agency of the Federal executive branch but displays features similar to many private and voluntary organizations (PVOs). These organizations share a people-to-people approach, immersion in the local cultures, a small-scale focus, and the emphasis on meeting basic needs.

Important differences exist between the Peace Corps and PVOs, too: 1) the comparative overseas inexperience of most Peace Corps volunteers, 2) the lack of "institutional memory" within the organization due to its 2-year tours and 5-year staffing rules, and 3) the greater security provided by Federal funding.

The Peace Corps was created in 1961 to:

- help the people of interested countries meet their needs for trained personnel;
- help promote a better understanding of Americans on the part of the people served; and
- help promote a better understanding of other peoples on the part of Americans.

Since 1961, at least 100,000 Americans have served in more than 90 countries. Today there are some 5,400 volunteers and trainees in 60 nations, 2,400 of whom work in 23 nations in sub-Saharan Africa (U.S. Peace Corps, 1984a).

While the essential goals of the Peace Corps have remained constant, the Agency has undergone several changes. During its first decade, the great majority of volunteers had liberal arts backgrounds and little professional experience. As the program broadened in size and deepened in technical scope, questions emerged, both at home and abroad, whether the volunteers had adequate expertise and training. Economic development gained greater priority and less emphasis was given to cross-cultural exchange as a result. The proportion of "B.A. generalist" volunteers is a measure of this change; it declined from about 60 percent in the early 1960s to less than 25 percent in the late 1970s (Rice, 1981). The emphasis on specialized skills is accelerating in response to current needs, particularly in Africa, and greater efforts are being made to recruit volunteers in such fields as biology, agronomy, forestry, and environmental science.

Another trend, begun during the "new directions" of the 1970s, continues. The Peace Corps is emphasizing cooperative projects with donors such as AID and PVOs. For example, the Peace Corps recently launched an Africa Food Systems Initiative in response to the food crisis in Africa. This program calls for the Peace Corps "to work in conjunction with AID and several PVO partners to assist small-scale farmers develop, adapt and implement the appropriate technologies designed to overcome [current obstacles] and thus foster self-sustaining food systems" (U.S. Peace Corps, 1984b).

However, Tendler's (1982) analysis suggests that agricultural assistance has certain characteristics that may make PVO success in this area difficult. Many agricultural projects require a high degree of expertise. This is not compatible necessarily with the more generalist nature of many PVOs. It appears that the benefits of agricultural projects are especially vulnerable to monopoly by the rich and, while PVOs are generally regarded as particularly sensitive to reaching the poor, sometimes this cannot be documented. Many within the PVO community dispute Tendler's findings. They argue that limited agricultural expertise is required for work with simple technology for low-resource food producers and that professionalism is rising among PVO staff.

Good relations and frequent interactions with large government donors are particularly important in relation to technical areas such as agricultural research. The smallness of most PVOs means that they must rely on the large donors for state-of-the-art information on effective development methods. In most cases, PVOs have limited support systems to provide technical information to volunteers in the field. Therefore, cooperation,

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not competition, is likely to benefit large donors and PVOs.

Some assert that "governments stand to benefit tremendously by allowing private and voluntary efforts to take root in society and thereby provide effective entry points for public sector inputs" (Hyden, 1983). How best to accomplish this is not clear. Certain trends in PVO aid exist: 1) greater attention to long-term development, 2) accepting professional consulting roles, and 3) greater recognition that development education in the United States is important. If PVOs continue along this route, they would continue to supplement government aid programs but perhaps lose their pioneering role (Sommer, 1977). Their consulting role is likely to bring them into greater conflict with for-profit firms engaged in similar work.

Sommer urges that American PVOs seek new roles, cooperating with other PVOs worldwide. Such cooperation, especially with local African PVOs, is an explicit objective of some groups. American PVO leaders, however, note the difficulties of coordinating international and local efforts (Biddle, 1984). Special considerations apply to working with African PVOs. Generally, local PVOs are not strong. They have received little recognition in their own countries and are weaker than those in other developing countries. They may offer an important way to compensate for government failures and complement more appropriate government efforts, but they will need outside assistance for some time in order to develop a stronger local base (Hyden, 1983).

Issue 14: The extent to which American businesses will provide technical assistance to low-resource food producers is limited.

Preliminary Findings

- The U.S. Government is beginning a major initiative to bring American private enterprise into development assistance, but it appears that most investment will be outside of the agricultural sector.
- Technology developed by multinational firms for poor countries often emphasizes capital intensive inputs rather than technologies more appropriate to the needs of the low-resource producers.
- Private investment generally goes to more wealthy developing countries with more developed infrastructures, more developed markets, and greater political stability.
- Problems of accessibility, limited capital, and needs for varied packaging make low-resource producer markets unattractive to agribusinesses.
- Incompatibility exists between the profit-maximizing strategies of agribusiness and risk-aversion practices of low-resource producers.
- U.S private sector involvement in agricultural technology for low-resource farmers in sub-Saharan Africa is primarily in the form of development assistance programs financed through the U.S. Agency for International Development.
- Certain critical components of agricultural development assistance probably will not and cannot be provided by the private sector. Therefore, a unique obligation remains for the Federal Government.

Discussion

The Federal Government is encouraging the U.S. private sector to invest in low-income developing countries. It has established such bodies as the Bureau of Private Enterprise within the U.S. Agency for International Development and the Overseas Private Investment Corporation (OPIC). The objective of encouraging U.S. private sector investment in developing countries is to boost trade, create jobs, nurture indigenous entrepreneurial activity, develop management skills, and provide increased capital flows into countries.

Private enterprise is seen as "the engine that makes growth occur most quickly" (U.S. AID, May 1982b). The focus of these initiatives will be on those developing countries with more developed infrastructures and markets and which display sociopolitical atmospheres conducive to free market initiatives. As a result, the primary beneficiaries will likely be the relatively wealthy countries in the developing world, despite efforts to encourage investments in the poorest countries.

While the goals mentioned above would benefit an African country's overall economy, the ability of U.S. private enterprise to benefit the agricultural sector directly, and in particular assist low-resource producers in increasing food productivity, is uncertain.

Direct private investment in agriculture in Africa historically has been in large plantation-type agriculture emphasizing export crops. Even in this area, however, investments have been limited in recent years largely due to concerns over nationalization or other government interventions. Rather, most transactions have been sales of inputs and purchases of outputs for processing (Lipton, 1977a).

While up to 90 percent of farming in Africa is done by the traditional sector, this group remains a "peripheral" market for agribusiness products such as seeds, fertilizer, agricultural chemicals, mechanical motive power, and processing equipment (Turner, 1984). Only about 10 percent of purchased farm inputs in Third World countries go to farmers cultivating under 10 acres of land (Lipton, 1977b).

While the low-resource producer markets for agricultural inputs are potentially very large, they are not spectacularly lucrative. Western-based suppliers face a variety of problems including:

1. Problems of accessibility, both physical and mental: Poorly developed infrastructures and the remoteness of many producers result in high transportation costs. Making low-resource producers aware of available products and encouraging them to use them can cause further problems with inappropriate scale of use.
2. Possible unsuitability of available technologies: Most technology is designed around Western (capital intensive) agricultural systems and is not suitable for low-resource producers in developing countries.
3. The pattern of government policies and priorities in poor countries: In many countries there is a reliance on quasi-governmental bodies to handle distribution and purchases. There are also inadequate incentives for food production in the rural sector in most countries (Lipton, 1977b).

The great bulk of world trade in agricultural inputs is between developed countries. As such, the products of agribusiness are designed to meet the needs of developed country commercial agriculture rather than those of the peasant farmer. The technologies developed are most often inappropriate for the rural sector in sub-Saharan Africa and can cause serious problems. "The increased use of agricultural inputs [tends] to modify and, in some cases, distort the farm structure in these countries to accommodate the new inputs" (Clayton, 1977).

Western manufacturers, in general, have difficulty adapting to low-resource producer markets. In particular, conflicts arise between the industries' desire to exploit economies of scale in research, design, transport, and storage, and their need to adapt to low-resource producers' input requirements and local circumstances (MacKintosh, 1977). Low-resource producers require a multitude of package types, chemical formulations, languages, soil conditions, and active ingredients. Providing safety instruction and follow-up monitoring, particularly on potentially toxic inputs, present further problems (Lipton, 1977d).

Limited liquidity and difficulties in obtaining credit cause serious problems for businesses trying to expand markets to low-resource producers. Perhaps more difficult to overcome, however, is the divergence between profit-maximizing strategies of agribusiness firms and the risk-aversion practices of low-resource producers.

> [A]gribusiness has been conditioned by and has responded to the capitalistic, profit maximizing agriculture of the developed world. The operating environment of the peasant farmer is very different from this. [They] often operate within a vicious cycle of poverty which limits [their] farming objectives and opportunities for farm inputs. [Their] energies are constrained by limited knowledge, inadequate land and capital resources, a risky physical economic environment and inadequate infrastructure (Clayton, 1977).

To take advantage of the potential traditional sector market, it is essential to account for the needs of the low-resource producer. Clayton (1977) suggests some steps that should be taken:

1. adapt farm inputs to match the scale of peasant farming,

2. improve the marketing and distribution of inputs to the advantage of small farmers, and
3. temper straight commercial objectives to take account of the real development needs of poor countries.

In emphasizing the role of private enterprise as an agent for development in Africa, some people believe that the U.S. comparative advantage in agriculture and the major importance of agriculture to African economies make this sector an appropriate focus for U.S. agribusiness involvement (Andreas Task Force, 1984). However, the technologies and agricultural system that have enabled the United States to become the "breadbasket of the world" are not necessarily transferable to Africa. Thus the idea of comparative advantage, at least in terms of technology transfer, loses validity. Witness OPIC's efforts to expand its insurance and lending for agricultural projects but its difficulty in finding suitable projects (Andreas Task Force, 1984). OPIC's 1983 annual report suggests that of 104 projects supported, only 9 were located in sub-Saharan Africa, and of these none were directly related to agriculture.

The current development agency focus on rural development projects has provided a boom to those businesses who produce for low-resource producers, the so-called "appropriate technology" firms. Indications are, however, that most of these exporting firms lie outside the United States. Many operate in countries that have historic colonial ties to their markets, although India and China present serious competition because of their large domestic markets that support export sales (Turner, 1984).

The United States also seems to be disadvantaged due to a more contentious factor—the practice of certain countries (e.g., France and Japan) to heavily link their foreign aid policies to their industrial policies in an effort to expand their markets into developing countries. The result has been a frustration on the part of American firms who think they are losing ground in developing-country markets as a result. This has prompted increased pressure on the U.S. Government to practice a similar strategy (U.S. Congress, Joint Economic Committee, 1982; Commission on Security and Economic Assistance, 1983). For the most part, the United States has refrained from linking its foreign aid policies and industrial policies because it recognizes the need to "press hard for free markets, open access to markets, and for the overall benefits of comparative economic advantage in producing and distributing the free world's products and services" (Andreas Task Force, 1984).

The vast majority of agricultural equipment sales to African countries come from Western manufacturers. United Nations figures indicate that of the estimated $1 billion of agricultural equipment sold to Africa (most representing tractors and tractor-drawn implements for the commercial agricultural sector), local manufacturers account for only $150 million (Turner, 1984). There is a growing sense, however, that "large-scale imports of basic equipment can only be a short- to medium-term solution to supplying the African farmer. If programs to improve productivity are to be sustained, equipment will have to be supplied from within Africa itself for foreign exchange consideration if nothing else" (Turner, 1984).

While it is unlikely that most African countries will be able to develop indigenous industries to produce large equipment in the near future, the potential for further development of smaller scale industries, especially those that could meet the needs of low-resource producers (e.g., small-scale machinery, implements, and fertilizers) can be seen as a realistic short-term goal. However, problems have been encountered by such businesses currently operating in Africa. A 1983 U.N. Industrial Development Organization (UNIDO) report states that the approximately 70 companies in Africa producing for the traditional sector were "in crisis, with nearly all facing financial and structural difficulties and many in danger of going bankrupt or being forced to diversify out of agricultural machinery supply."

Many of the problems these companies face are common to much of African industry: shortage of spare parts and raw materials, and a lack of technical and management skills. These latter constraints provide an area where U.S. private sector involvement could prove very useful, such as the International Executive Service Corps (IESC).

Other problems exist that are particular to producing for the low-resource producer: general insolvency of the clients and consequent limited market size. In addition, government policies have sometimes exacerbated problems (Turner, 1984). These problems would also be encountered by U.S. investments and are, in large part, responsible for the limited investment in African countries. Sub-Saharan Africa represents a mere 2 percent of total U.S. direct investment abroad (Stokeld, 1982).

The above analysis provides a rather skeptical view of any extensive U.S. private industry involvement in Africa. Perhaps it should be clarified that this skepticism is focused on the ability of U.S. agribusiness to assist directly with the traditional African agricultural sector. There are areas of agricultural sector development where U.S. private investment may prove much more effective and profitable, particularly in such areas as food processing and marketing infrastructure. However, in developing mechanized food processing operations, consideration should be given to the impact on the low-resource producers, particularly potential adverse impacts on income generation through their own processing activities.

The creation of a free enterprise environment may result in a greater shift of low-resource producers away from a largely subsistence economy toward a market economy. The greater liquidity and market structure this creates would likely provide increased incentives for private sector investment in low-resource producers. In the meantime, however, profitability in such investments is limited, particularly in the poorer countries in sub-Saharan Africa. As such, increasing productivity in this sector will continue to rely predominantly on investments from the public sector.

Chapter 6

Issues for the African Governments

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Technology development, technology transfer, and technical assistance each have an important function to perform if food production in Africa is to be increased. The primary responsibility for improving food production, however, lies with the African governments themselves. What is needed is a continuing, active commitment to food production—an ability to translate rhetoric into action.

This chapter examines the many, sometimes complicated, issues for which the African governments themselves are responsible. One critical issue facing African governments is their inadequate institutional foundation, which makes it difficult to plan and manage far-reaching development strategies. African governments also face increasing pressure to reform economic policies. An issue often neglected in the face of more visible or immediate problems is the status of the natural resource base; a firm commitment to sustain their natural resources is essential to long-term agricultural development in Africa.

Issue 15: The commitment of African governments to sustaining the natural resource base is critical to long-term agricultural development.

Preliminary Findings

- Research on soil erosion and conservation in Africa is weak or non-existent. Few countries have conservation programs capable of dealing with the magnitude of the problems they are facing.
- Conflicts exist at the national level between short-term objectives of meeting immediate needs and long-term objectives of maintaining natural resources.
- The combination of increased population pressure on the land and the degree of land degradation that continues to occur in many parts of Africa suggest that the resource base may no longer be able to support a continuation of many traditional agricultural practices.
- An urgent need exists in many countries to reduce the rate of land degradation, reclaim land already degraded, and introduce or adapt production methods that fit the constraints of the natural resource base.
- In examining strategies for reducing land degradation, an integrated approach should be taken that looks at the entire production system.
- For conservation programs to be effective, support and involvement are needed from the rural population. It is unlikely that simply legislating programs will work.
- Problems of environmental degradation in Africa are quite different from those in industrialized countries. In Africa, environmental problems stem predominantly from poverty. Development and industrialization are perceived as cures for, rather than causes of, environmental degradation.
- Environmental awareness by African governments is a relatively recent phenomenon and, unlike in most developed countries, it has been stimulated from outside the country. There is some suspicion and apprehension by many African governments that outside emphasis on environmental issues represents efforts to stem industrial development in Africa.

Discussion

The magnitude of problems facing most countries in sub-Saharan Africa is enormous. These problems are due not only to food shortages but also are a result of economic woes resulting from stagnant economic growth and an inability to generate adequate foreign exchange. In addition, several countries are facing civil strife or are engaged in war. In light of the immediacy of these problems, it is understandable why countries have been unable or reluctant to address the longer term questions of degradation of their natural resources.

Compounding the problem is the difficulty of the task at hand. Hudson (1983) takes the perspective of relating the problems facing Third World countries' efforts at soil conservation to those in the United States:

> If you think you have problems in making soil conservation work in the United States, spare the thought for countries in the Third World, where the problems are much worse and the difficulties of applying solutions are much greater. [If] soil conservation cannot be made to work effectively in the United States, with all the advantages of research, extension, and conservation services, plus wealthy, educated farmers on good land with gentle climates—if with all these benefits conservation is not successful—then what hope is there for struggling countries that have few, if none, of these advantages.

Land degradation is caused by a variety of often interrelated processes: soil erosion, deforestation, overgrazing, waterlogging and salinization, damage by sedimentation, inefficient cultivation practices, shortened fallow periods, and spreading deserts (McPherson, 1984). In terms of its impact on Africa's agriculture, the implications are alarming. Estimates suggest that with the current rate of soil loss, Africa could experience a decline in its potential rain-fed crop production of about 15 percent during the next two decades (McPherson, 1984).

The problems stem largely from the poor quality of African soils. The continent did not experience the glaciation that created the more robust soils in other continents. In general, African soils tend to be highly weathered, with a low humus content (which is important for providing nutrients and retaining moisture) and are very susceptible to damaging processes such as erosion and leaching (Lofchie and Commins, 1984). Some soils that are rich in nutrients and capable of supporting relatively intensive agriculture do exist in the region, however, such as the volcanic soils of the Kenyan Highlands.

Ecological variability (fig. 10) presents problems in itself as it adds complexity to the task of formulating "environmentally conscious agricultural planning" (Lofchie and Commins, 1984). Adding further complexity is the variability of social and cultural factors that play a large role in land use patterns.

In formulating strategies to combat land degradation, it is important to look at the full array of human activity that contributes to the problem in a given region. The diversity and interrelationships of these anthropogenic modifications of the environment were examined for the West African Sahel (National Research Council, 1984). Nine major activities were defined that contributed to the decline in the region's ability to support human populations: bush fires, trans-Saharan trade, site preferences for settlements, gum arabic trade, agricultural expansion, proliferation of cattle, introduction of advanced firearms, development of modern transportation networks, and urbanization.

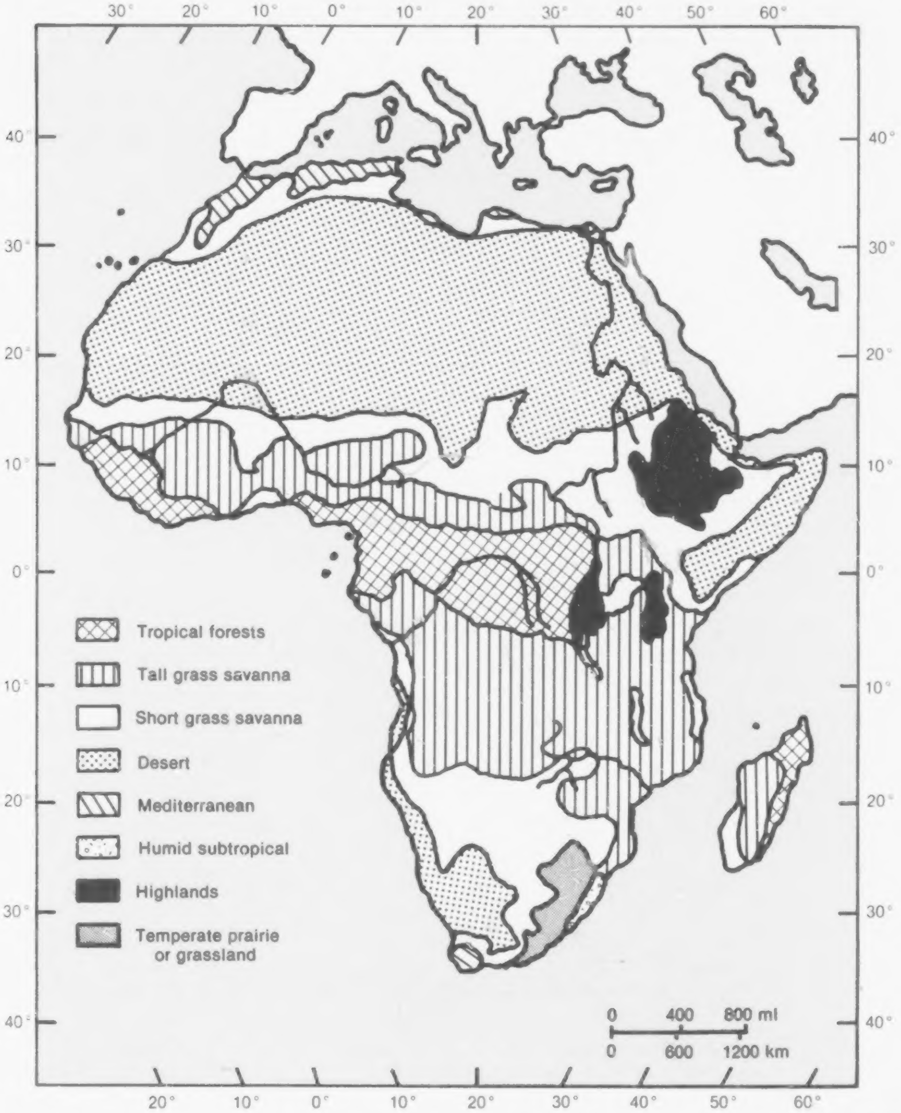
Most tropical forests in Africa also are severely threatened as a result of stress on the system. In Ivory Coast, for instance, timber cutting for export has resulted in a shrinking of the forest to one-third of its size only 25 years ago (Lofchie and Commins, 1984).

Most likely, peasant farmers and pastoralists are aware that some of their activities damage their resources. But few alternatives exist because they are striving to meet the most basic needs (Hudson, 1983). This is particularly true regarding subsistence producers faced with the need to move into marginal lands (see Box D). The responsibility falls on the governments to address the problem.

In describing the solutions needed for one form of environmental degradation, Erik Eckholm wrote that "desertification is seldom a technical problem that can be solved with an injection of knowledge and money alone. It is a socio-economic and developmental problem linked to basic patterns of national life . . . (solutions) require difficult political, cultural and bureaucratic reform" (Cross, 1983). It is unlikely, however, that simply legislating programs of land use would be effective. To succeed, conservation efforts must have support "from below," as they will have to do the work. Full involvement of the rural sector is required (Hudson, 1983).

Research on soil erosion and conservation is weak or nonexistent in Africa. Some basic theory

Figure 10.—Ecological Areas of Africa



SOURCE: Adapted from P. O'Meara and P. Martin (eds.), *Africa*, Indiana University Press, *In:* E. F. Moran (ed.), "Changing Agricultural Systems in Africa," *Studies in Third World Societies*, No. 8, July 1979.

can be applied generally but site specific data is required. Some regions can make use of international or national research centers, but many cannot. In addition, national research organizations have difficulty obtaining information. There are a limited number of experienced soil conservation scientists, since this is not a priority field in most African countries (Hudson, 1983).

Fundamental differences exist in how environmental problems are viewed in Africa and in developed countries. In Africa, environmental prob-

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Box D.—How Much Land, How Many People?

Africa is often portrayed as an underpopulated region with vast acres of untapped land. It is true that its average population density is low—less than one-fifth of Asia's. But considering the rudimentary farming practices in most of Africa, some countries are becoming crowded, at least in the sense of limited food production potential. This is one of the main findings of the FAO's recently completed project, Land Resources for the Future.

Of course, the goal of self-sufficiency in food production cannot be recommended for all countries. But those that do not manage it must generate enough foreign exchange outside of agriculture to import food (or face the prospect of continuing dependence on food aid or rising malnutrition). For many African countries, nonagricultural exports are unlikely to provide a viable short-term source of foreign exchange.

The Food and Agriculture Organization (FAO) compared potential population-supporting capacities—determined by soil and climatic conditions and levels of farm technology—to actual and projected populations. The calculations for Africa as a whole confirm the conventional wisdom: even at subsistence farming levels (i.e., no use of fertilizers or pesticides, traditional seed varieties and cropping patterns, and no conservation measures), there is enough land to allow food self-sufficiency for a population 2.7 times larger than the actual population in 1975. When the results are tabulated by country, however, a much more complex picture emerges.

Of 40 sub-Saharan countries (excluding Djibouti and the smaller island nations), 14 do not have enough land—assuming subsistence level farming—to support on a sustainable basis populations as large as those already reached in 1975. The 14 are Botswana, Burundi, Ethiopia, Kenya, Lesotho, Malawi, Mauritania, Namibia, Niger, Nigeria, Rwanda, Senegal, Somalia, and Uganda (see map); as a group, they account for one-third of the land area of sub-Saharan Africa and about half of its 1981 population.

In some areas of these countries—parts of Kenya, Ethiopia, and Nigeria, and much of Rwanda and Burundi—higher levels of inputs in denser areas mean more people are being supported. But these countries will face increasing difficulties as populations double again in the next 20 to 30 years. Small landlocked countries such as Rwanda and Burundi face particularly serious problems. Population pressure has led to more intensive farming methods, based on higher and higher labor inputs. But the remoteness of the countries and their terrain make it expensive to use advanced technologies; they also limit agricultural and nonagricultural export opportunities, and thus the scope for importing food. Low rainfall and remoteness also create considerable problems for Sahelian countries like Niger.

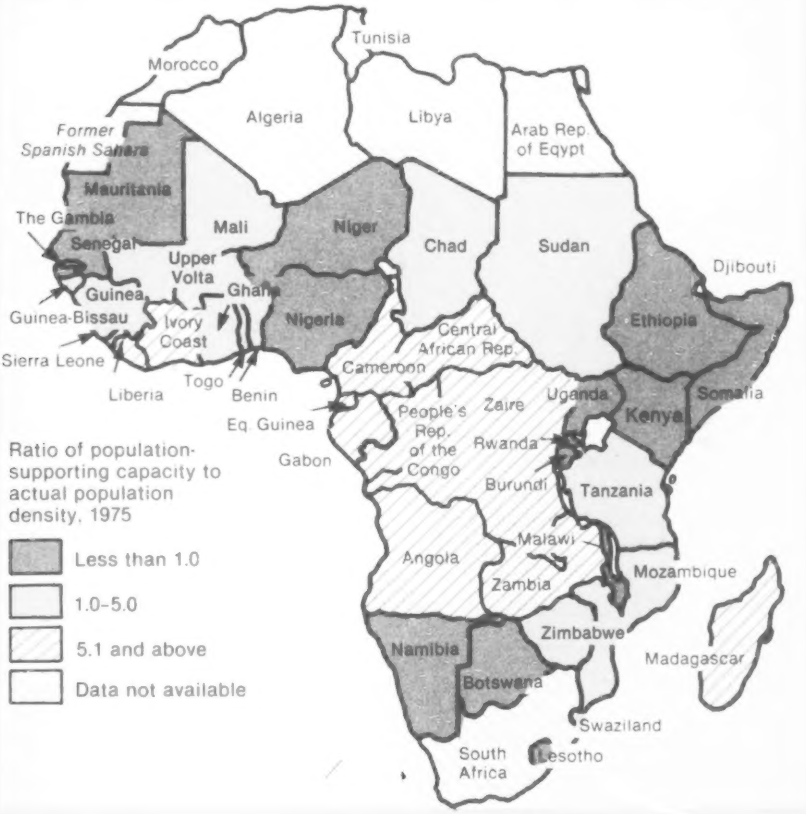
Nevertheless, there are 11 countries, largely in central Africa, still possessing extensive areas of underused land. According to FAO, the land of the Congo and the Central African Republic is capable of supporting populations more than 20 times larger than they had in 1975; in the case of Gabon, the multiple reaches almost 100. Together, the land-abundant countries of sub-Saharan Africa occupy about 30 percent of the region's land but account for only one-fifth of its 1981 population.

As populations increase further in the land-scarce countries of sub-Saharan Africa, the pressure for people to migrate to land-abundant countries will mount, particularly where they share a common border. Migration already brings mutual benefits to countries such as the Ivory Coast and Upper Volta. As pointed out in chapter 5 (World Bank, *World Development Report*, 1984), however, the opportunities for accommodating population growth through international migration do have limits. Political and social factors introduce uncertainty even where economic benefits could be great. The recent expulsion of Ghanaians from Nigeria provides an example.

Throughout Africa, traditional methods of farming require more land per capita than in regions such as Asia, where irrigation and double-cropping are more common. To avoid a fall in agricultural output per worker, land-scarce countries will require new technologies—fertilizers, improved seed, and different farming techniques—supported by pricing policies to encourage production. But such meas-

ures alone might not be enough. According to FAO's calculations, seven sub-Saharan countries—Burundi, Kenya, Lesotho, Mauritania, Niger, Rwanda, and Somalia—would not achieve self-sufficiency in food in the year 2000 (when their combined population is expected to reach about 80 million) even if their agricultural techniques were to match those now found on commercial farms in Asia and Latin America.

SOURCE: World Bank, *World Development Report* (New York: Oxford University Press, July 1984), Box 8.4, pp. 164-165, appears with permission.



lems are predominantly related to poverty. In developed countries environmental problems are often related to industrialization. In Africa, therefore, development and industrialization are seen as cures, rather than causes, of environmental problems (Howard-Clinton, 1984).

A further problem exists in how certain African governments perceive developed countries' emphasis on African environmental problems. Some African governments view this concern as a means of retarding African industrialization. Howard-Clinton (1984) sees this related to the evolution of environmental awareness among African governments. Unlike the experience of most developed countries, concerns over environmental issues were addressed to governments from outside their borders (many starting with 1972, U.N. Con-

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ference on the Human Environment in Stockholm), rather than by national scientists or environmentalists and the general public (Howard-Clinton, 1984). It is in this North-South context that this apprehension exists.

In examining the benefits of conservation efforts, a long time-frame is required. This presents serious problems for both African governments and African farmers and pastoralists.

> . . . [T]he managers of . . . national land resources are also . . . political leaders. Their time scale seldom extends beyond the date of the next election. On the whole, they are not interested in long-term conservation. The farmer's [and herder's] economic cycle is even shorter. [They are] probably working on cash flows over 12 months, so it is unreasonable to expect [them] to pay now for preserving the land for posterity. That is a luxury [they] cannot afford (Hudson, 1983).

In examining who should pay for conservation programs, in wealthier countries it makes sense to have this cost borne by those who use or degrade resources. In developing countries, however, the poor farmers and herders simply cannot afford this; therefore, the burden falls on the government. A financial commitment of this level is a major undertaking for any government. United Nations figures suggest that to rehabilitate all damaged irrigated land, half the affected rangelands, and 70 percent of rain-fed farmland over the next 20 years would cost $48 billion (Cross, 1983).

Some encouraging signs exist that some governments, supported by the rural sector, are taking action. Most notable is Kenya, which mobilized its national institution "Harambee" (meaning "self-help") and, with strong support from President Daniel Arap Moi, has developed a major soil conservation program. In addition, in 1982, FAO published a "world soil charter" as a means of encouraging government support for soil conservation efforts. Without such efforts, the charter predicts, productive capacity of land could decrease 20 percent by the end of the century (Cross, 1983).

While it is apparent that successful efforts to reduce land degradation will require firm commitments by national governments, there are ways U.S. assistance could be effective. One is obviously through financial support, such as through World Bank conservation projects. In addition, the United States could take better account of the particular environmental constraints in assisting African governments plan agricultural development strategies. "The relationship between environmental deterioration and agricultural stagnation is still too often ignored in the formulation of strategies" (Lofchie and Commins, 1984). The United States could also assist African governments in compiling an inventory of resources and assist in the development of baseline data on resource degradation in order to identify areas most seriously affected.

An integrated approach to solving land degradation, and development problems in general, should be taken. There is a "need to look at the entire production system and to understand interrelationships between people and such components as food crops, livestock and feed supplies, trees, soil fertility, water quality and quantity, and housing supplies" (McPherson, 1984). Recent research efforts show promising results in addressing certain aspects of land degradation through strategies using an integration of crops, animals, and trees (Brumby, 1984).

Issue 16: Institutional and human resource development in Africa is inadequate, thus making improved indigenous management systems critical.

Preliminary Findings

- Institutions, especially those engaged in research and training, are less developed in Africa than in Latin America or Asia.
- Some government institutions face major problems trying to coordinate the large amounts of project aid supplied by many donors.
- Proliferation of donor projects allows little institutional continuity; few incentives exist for host countries to plan programs that they truly need.
- Many projects fail because of administrative weaknesses and incompetence.

- Indigenous institutions are subject to the same development shifts as donor agencies.
- Countries have different approaches to management, and Western models, based on industrial societies, may be inappropriate.
- Human resource development is inadequate. International and national training programs commonly are insufficient to fill the number of needed research and planning positions. National in-service training courses are usually weak in disseminating new information.
- Training Africans too often is done in the United States when local and third country locations may be more appropriate.
- African universities generally are undersupported and underused in research activities. Few have any or adequate graduate level programs.

Discussion

The successful transfer of technologies depends on the availability of institutions that can effectively manage development programs. Problems exist at different levels with African institutions that deal with both program and project development. Some of the problems are inherent in bureaucracies everywhere but some raise questions about the assumptions and structure of efficient African management systems. Some problems relate to individual human factors and some are due to inefficient levels of financial and human resources. Government institutions in most African countries have been inundated with donor project assistance for rural development. The proliferation of aid renders many ministries incapable of coordinating donors' projects and interests. The Ministry of Agriculture in Malawi, for example, reported 44 donor-financed projects in 1981 (Morss, 1984). Coordination of this number of projects requires inter- and intra-ministerial coordination that can strain existing staff levels. Coordination is also hampered by power struggles between various ministries. Delegation of responsibility is then transferred to local government units with few human and financial resources available to implement rural development projects (Morss and Morss, 1982).

Donors have attempted to strengthen institutions through infrastructural support and overseas training. Buildings have been constructed for schools, research stations, and ministry and local government office space. Staff members from central ministry levels have attended U.S. universities, but they usually obtain undergraduate and graduate degrees in technical areas. Technical staff sometimes acquire limited management and organizational skills through short courses on rural development and management planning given by organizations like the USDA graduate school. With this limited managerial training, technicians frequently become ineffective managers.

The options normally available to correct weak institutional development imply more donor assistance for graduate level technical and management training. There have been calls for additional funding from several sources (Lele, 1981; World Bank, 1981). However, an increasing number of people recognize that human resource development through overseas training may not improve management skills significantly. Organizational and social realities in Africa may necessitate alternative management strategies—ones that may not seem as efficient initially but which fit into the cultural setting. Until then, project implementation and technology transfer will continue to be difficult and non-replicable once donor agency representatives leave. African management systems share similarities that may be contrary to Western management ideals. Some of these are:

1. flexible attitudes that regard "contracts" as conditional based on the outcome of unspecified events.
2. policy that is not dependent on precedent. Decisions are spontaneous and usually have little institutional memory.
3. flexible attitude toward time management due to high levels of uncertainty in most African developing countries.
4. bureaucracies that are structurally overdeveloped and hierarchically complex.
5. limited opportunities for advancement creating competitive struggles. Therefore, few alternative policy suggestions are made for fear of alienating superiors (Moris, 1981; Hyden, 1983).

Management systems could develop according to African desires and expectations so that incentives exist for project implementation and maintenance. African governments could "identify new management training methods that enable managers to become more effective in the African environment" (Hyden, 1983). Donors, on the other hand, could relinquish some control over the use of their funds to ensure that recipient governments have some interest in maintaining and replicating beneficial projects. Donors could consider the possibility of providing program support instead of project support as a means of allowing governments more autonomy (Morss, 1984).

> By far the most unquestionable though unquantifiable benefit of education to Africa would be that of learning by doing, which is now lost to that ever growing and changing expatriate community. It is ironic that most African countries do not have the capacity to propose alternative plans to those presented by donors for using donor funds to reflect their own long-term needs for higher education (Lele, 1981).

Issue 17: Though facing increasing external pressure to change, African governments maintain economic policies that generally favor urban consumers instead of providing incentives for low-resource producers.

Preliminary Findings

- Keeping the urban prices of food, goods, and services low is important to African governments.
- Agricultural policies in most African countries apparently provide little incentive for increasing smallholder production.
- Several African governments provide quasi-governmental marketing outlets for agricultural produce, which may set prices, supply inputs, and market produce.
- Official market grain prices are set artificially low to ensure subsidized food prices for the urban populace and thus political stability.
- Many feel that little indigenous pressure exists for agricultural policy reform; thus many external financial institutions and some donors are taking measures to influence African policies by providing conditional assistance.
- International financial institutions and AID generally support a package of macroeconomic measures intended to stimulate export trade, reduce spending, and increase incentives for increased agricultural production.
- The International Monetary Fund (IMF) usually recommends devaluation of local currency to stimulate export trade. This measure, however, raises the cost of all imported farm inputs (e.g., fertilizer and implements) and imported food.
- Both of these internal economic adjustments affect the ability of the low-resource producers to invest in increased food production technologies and diminish the internal purchasing power of the poor.
- Numerous factors affect the productivity of food crops, and increases in production prices without other policy changes may not increase the production of food crops.
- Pressure for policy reforms is a very sensitive issue because it involves the question of national sovereignty.

Discussion

The long-term decline in food production in Africa has been blamed on many factors: lack of incentives for producers, lack of appropriate research on food crops, poorly developed extension and management systems, general insensitivity to cultural and environmental conditions, failure of governments to deliver physical and economic inputs on time, and inability to identify the problems facing low-resource producers. Another factor receiving major attention is the impact of macroeconomic policy upon agricultural production.

During the past two decades, African governments generally opted for economic policies that favor urban consumers. Up until 1979, prices paid to farmers in most countries were set below world market commodity levels so that urban food prices could be kept low (Christensen and Witucki, 1982). Trade policies and official currency overvaluation also allowed the importation of relatively inexpensive food and consumer goods (Christensen, et al., 1984).

African governments now face several conflicting forces that threaten to undermine their own economic independence. During the early 1970s, the commercial banks offered relatively low-interest loans and because many African governments depend on external sources of capital for development, these loans were attractive. This borrowing, and that necessitated to meet late 1970s balance of payments deficits, left sub-Saharan Africa with projected average annual commercial amortization payments of $8 billion, exclusive of International Monetary Fund (IMF) obligations of $1.6 billion (Browne, 1984).

In response to growing debt, they have turned to the IMF to reschedule some of their loans. However, the IMF loans require the fulfillment of certain conditions including:

1. devaluation of local overvalued currencies to match internal rates of inflation;
2. limitations on the level of domestic spending, including wage ceiling levels and the elimination of subsidies on consumer goods;
3. elimination of unprofitable government enterprises (e.g., marketing parastatals);
4. relaxation of price controls;
5. increase in interest rates; and
6. expansion of exports and reduction of imports (Browne, 1984).

Several countries (e.g., Tanzania and Nigeria) have resisted the IMF measures and maintain that they are too severe, especially in the short run. Most developing countries rely on one or two major export crops (e.g., cocoa, coffee, tea, or cotton) for foreign currency, and devaluation of local currency theoretically makes exports more attractive to other countries. But levels of demand for the exports is fairly inelastic for many of these commodities because of consumer preferences within developed countries. Devaluation conversely causes increasing prices for imported consumer goods, and shifting demands affect the prices of other domestic goods. Therefore, to developing countries, raising the ceiling of price controls and devaluation of local currencies probably mean increasing costs for imported food to urban consumers, a restriction in the availability of basic goods and services, and increasing costs for imported agricultural inputs (especially fertilizers), while not necessarily increasing export revenue to compensate for the costs of such policy changes. In the short-run, African governments express concern over the possibility of political instability, substantial protests, or food riots.

The World Bank and AID, among others, also stress the importance of governments developing agricultural policies that encourage small producers to increase production of food and cash crops (World Bank 1981; U.S. AID, 1982). Although the World Bank argued that price incentives were most important in 1981, more recently they have suggested that improving the performance of the agricultural sector means more than "getting your prices right" (World Bank, 1984a). However, they appear to require that several conditions similar to those of the IMF be met to receive continued development assistance (Stokeld, 1982). Agricultural policy adjustment includes support for infrastructural research, extension, and human resource development but primarily stresses the need for macro- and micro-economic reforms. For example, AID considers an appropriate policy framework as one that:

> . . . relies largely on free markets, the provision of production incentives [which] are affected by direct attempts by government to influence the prices of food or agricultural products and inputs, but in many countries macro-economic policies affecting exchange rates, interest and wage rates and tariffs and taxes have an even more powerful impact on incentives to produce, employ, consume, save, and invest (U.S. AID, 1982).

Increasing producer prices paid to agriculturalists and herders may exacerbate the problem for African governments. Without subsidies, the prices of domestic agricultural products will increase along with those of imported food stuffs. Evidence exists suggesting that increases in producer prices for a specific crop will stimulate more land to come under cultivation and higher total yields for that crop (Christensen and Witucki, 1982). But it is not clear who would benefit. With no new technologies available, production increases will require more inputs of fertilizers and purchased inputs. Therefore, the farmers most likely to benefit are those who can afford to purchase the necessary inputs, not the overwhelming number of subsistence farmers who may not be engaged in agriculture as a full time occupation (Christensen, et al., 1984; Christensen and Witucki, 1982; Eicher and Baker, 1982).

Price incentives for one crop (e.g., maize) may also cause producers to shift their emphasis between crops, not increase production (Eicher and Baker, 1982). A number of non-price factors may instead affect the level of productivity substantially compared with the effects of producer price increases. Lack of reliable rainfall, timely delivery of agricultural inputs, seasonal labor, extension advice, suitable technologies, and marketing infrastructure remain serious constraints.

For the African herder, livestock may represent more than an economic good. The number of stock accumulated depends on many complex social, environmental, and political decisions in addition to economic responses. Increased prices will not necessarily bring more cattle into the marketplace (Horowitz, 1979).

The calls for more reasonable macroeconomic policies and appropriate incentives to rural producers seem valid. It appears that the rural sectors of many African countries require some incentives and support for increasing production. However, the conditions for IMF loans and continuing multilateral and bilateral development assistance could be more palatable politically to African governments. Donors could do more to recognize the constraints that African governments face. A recent study indicates that only 20 percent of the African countries following the IMF economic adjustment programs met the proposed economic growth targets. In light of this, there are several ways that the IMF could assist African developing countries without stripping them of their autonomy. The IMF could show more flexibility in working with the African governments in working out longer term devaluation and cost reduction measures. Further, the political and economic realities of African countries have to be considered by the IMF when negotiating, for it continues to be the responsibility of the African governments themselves to readjust their economies (Mtei, 1984).

> It should be understood that for any program to be successful, it must be supported by the people of the country implementing the program, and the atmosphere of peace and social stability must prevail (Mtei, 1984).

Appendixes

Appendix A

List of Additional Reviewers

These persons, in addition to participants in OTA's September workshop, reviewed the draft Technical Memorandum:

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Appendix B

The CGIAR in Africa

Considerable interest exists in the work of the international agricultural research centers that are part of the Consultative Group on International Agricultural Research (CGIAR). This short description of the CGIAR's work in Africa was prepared by the CGIAR office in Washington, DC, and appears with permission.

Introduction

1. This paper presents a brief overview of the role and activities in Africa of the 13 international agricultural research centers (IARCs) funded by the Consultative Group on International Agricultural Research (CGIAR). Four of the centers are located in Africa and most of the other centers have significant programs in Africa.

2. The CGIAR was organized in May 1971 to bring together countries, public and private institutions, international and regional organizations, and representatives from developing countries in support of a network of international agricultural research centers and programs. The basic objective of this effort was then, and is now, to conduct research to produce technologies or technology components that will lead to an increase in the quantity and improve the quality of food production in the developing countries. The research supported by the Group concentrates on those critical transferrable aspects of food production in the developing countries that are not adequately covered by other research facilities, and which are of wide usefulness, regionally or globally. Currently, the CGIAR network is involved in research on nearly all of the major food crops and many of the farming systems in the major ecological zones of the developing world (table B-1).

3. The international center's research and training activities deal with crops and livestock that encompass three-quarters of the food supply of the developing countries. These centers have already made significant contributions toward increasing food production in the developing countries. The total system is small, however, with expenditures of less than $200 million in 1984, compared to an estimated $2.6 billion spent by developing countries in 1980, and project loans/credits for agricultural research by the World Bank and IDA of $1.0 billion since 1980.

Current Activities

4. Africa figures very prominently in the current work programs of the international agricultural research centers funded through the CGIAR. Four of the 13 centers have their headquarters in African countries, and all the others have outreach activities that involve African countries in various ways. Table B-2 shows there were 291 IARC staff stationed in West, East, and Southern Africa in 1983 and that 122 of them were outside the four countries hosting Centers, mostly in outreach or "country programs." Outreach activities usually take the form of cooperative research programs in conjunction with national or regional institutions, or with other international institutions operating in Africa.

5. *IARCs headquartered in Africa*. The four centers that have their headquarters in Africa are the International Institute of Tropical Agriculture (IITA), the International Livestock Center for Africa (ILCA), the International Laboratory for Research on Animal Diseases (ILRAD), and the West Africa Rice Development Association (WARDA).

6. *IITA* (the International Institute of Tropical Agriculture), located in Ibadan, Nigeria, was the first international agricultural research center on the African continent. In the CGIAR system, IITA has worldwide responsibility for the improvement of cowpea, yam, cocoyam, and sweet potato, and regional responsibility for cassava, rice, maize, and soybean. Another important program is devoted to improving traditional farming systems. The object of the farming systems program is the development of more productive and ecologically sound alternatives to traditional systems of bush fallow and shifting cultivation. IITA works in a number of African countries, usually with funding specially provided for work in specific countries, on programs relating to one or more of the crops for which it is responsible or on farming systems. From its inception, IITA has been strongly identified with research on important food crops of the humid tropical areas of Africa.

7. *ILCA* (the International Livestock Center for Africa), located at Addis Ababa in Ethiopia, was established in 1974 to assist national efforts in tropical Africa by carrying out research and development on improved livestock production and marketing systems, by training livestock specialists in their region, and by gathering documentation useful to the African livestock industry. ILCA is one of the two CGIAR centers in Africa devoted to livestock research. ILCA is primarily concerned with the improvement of livestock production systems. Dealing with livestock in the context of deeply traditional, complex and diverse farm-

Table B-1.—Centers Supported by the CGIAR, 1984

Acronym (year established)	Center	Location	Research programs	Geographic focus	1984 budget[a] (millions of dollars)
IRRI (1960)	International Rice Research Institute	Los Banos, Phillipines	Rice	Global	22.5
			Rice based cropping systems	Asia	
CIMMYT (1966)	Centro Internacional de Mejoramiento Maiz y Trigo	Mexico City, Mexico	Maize	Global	21.0
			Bread wheat	Global	
			Durum wheat	Global	
			Barley	Global	
			Triticale	Global	
IITA (1967)	International Institute of Tropical Agriculture	Ibadan, Nigeria	Farming systems	Tropical Africa	21.2
			Maize		
			Rice		
			Sweet potato, yams	Global	
			Cassava, cowpea, lima bean, soybean	Tropical Africa	
CIAT (1968)	Centro Internacional de Agricultura Tropical	Cali, Colombia	Cassava	Global	23.1
			Field beans	Global	
			Rice	Latin America	
			Tropical pastures	Latin America	
CIP (1971)	Centro Internacional de la Papa	Lima, Peru	Potato	Global	10.9
WARDA (1971)	West African Rice Development Association	Monrovia, Liberia	Rice	West Africa	2.9
ICRISAT (1972)	International Crops Research Institute for the Semi-Arid Tropics	Hyderabad, India	Chickpea	Global	22.1
			Pigeonpea	Global	
			Pearl millet	Global	
			Sorghum	Global	
			Groundnut	Global	
			Farming systems	Semi-Arid tropics	
ILRAD (1973)	International Laboratory for Research on Animal Diseases	Nairobi, Kenya	Trypanosomiasis	Global	9.7
			Theileriosis	Global	
IBPGR (1974)	International Board for Plant Genetic Resources	Rome, Italy	Plant genetic sources	Global	3.7
ILCA (1974)	International Livestock Center for Africa	Addis Ababa, Ethiopia	Livestock production systems	Tropical Africa	12.7
IFPRI (1975)	International Food Policy Research Institute	Washington, DC, U.S.A.	Food policy	Global	4.2
ICARDA (1976)	International Center for Agricultural Research in the Dry Areas	Aleppo, Syria	Farming systems	Dry areas of West Asia and North Africa	20.4
			Wheat, barley, triticale, broad bean, lentil, chickpea, forage crops		
ISNAR (1980)	International Service for National Agricultural Research	The Hague, Netherlands	National agricultural research	Global	3.5

[a] CGIAR supported core budget, net of capital, at the bottom of the bracket (from 1983 Integrative Report.)

SOURCE: Consultative Group on International Agricultural Research, "The CGIAR in Africa," Washington, DC, 1984

ing systems, ILCA is more concerned with systems analysis and management approaches and techniques than with individual commodities. Although cattle have received much research attention from ILCA, sheep and goats have also received considerable attention. ILCA focuses its research efforts on four ecological zones—arid, subhumid, humid, and highlands. ILCA's Humid Zone Program is based at IITA and the two centers cooperate in farming systems research in which animals do or may play an important role.

8. *ILRAD* (the International Laboratory for Research on Animal Diseases) was established in 1974 in Nairobi, Kenya, to assist in the development of effective controls for two major African livestock diseases: trypanosomiasis and theileriosis (East Coast Fever). Together these two diseases prevent livestock production in vast areas of a number of developing countries in Africa. The total foregone production—not only in milk and meat production, but also in production of leather, wool, fertilizer, animal power and

Table B-2.—Number of IARC Senior Staff, Visiting Scientists, and Staff on Deputation, Posted in Each Country, 1982 or 1983[a]

Country	Total	Scientists not in IARC's host countries	CIAT	CIMMYT	CIP	IBPGR	ICARDA	ICRISAT	IFPRI	IITA	ILCA	ILRAD	ISNAR	IRRI	WARDA
Total senior staff	757	231	73	77	73	15	63	84	30	105	50	30	29	104	68
Asia	***177***	***38***	***1***	***12***	***6***	***2***	***0***	***54***	***2***	***0***	***0***	***0***	***0***	***100***	***0***
Bangladesh	7	7	—	2	1	—	—	—	—	—	—	—	—	4	—
Bhutan	2	2	—	—	2	—	—	—	—	—	—	—	—	—	—
Burma	3	3	—	—	—	—	—	—	—	—	—	—	—	3	—
India	55	1	—	—	1	—	—	54	—	—	—	—	—	—	—
Indonesia	3	3	—	—	—	—	—	—	—	—	—	—	—	3	—
Pakistan	4	4	—	4	—	—	—	—	—	—	—	—	—	—	—
Philippines	90	5	—	—	2	1	—	—	2	—	—	—	—	85	—
Thailand	13	13	1	6	—	1	—	—	—	—	—	—	—	5	—
North Africa and Middle East	***74***	***15***	***0***	***1***	***4***	***2***	***63***	***2***	—	—	—	—	—	***2***	—
Cyprus	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Egypt	3	5	—	—	2	—	1	—	—	—	—	—	—	2	—
Syria	62	3	—	—	—	1	59	2	—	—	—	—	—	—	—
Tunisia	5	5	—	—	2	—	3	—	—	—	—	—	—	—	—
Turkey	1	1	—	1	—	—	—	—	—	—	—	—	—	—	—
West Africa	***207***	***100***	***0***	***2***	***0***	***2***	***0***	***22***	***0***	***100***	***12***	***0***	***0***	***1***	***68***
Cameroon	12	12	—	—	—	—	—	—	—	12	—	—	—	—	—
Gambia	2	2	—	—	—	—	—	—	—	—	—	—	—	—	2
Ghana	5	6	—	2	—	—	—	—	—	2	—	—	—	—	2
Guinea	2	2	—	—	—	—	—	—	—	—	—	—	—	—	2
Ivory Coast	1	1	—	—	—	—	—	—	—	—	—	—	—	—	1
Liberia	35	1	—	—	—	—	—	—	—	1	—	—	—	—	34
Mali	11	11	—	—	—	—	—	2	—	—	3	—	—	—	6
Nigeria	86	13	—	—	—	—	—	4	—	73	8	—	—	1	—
Niger	12	12	—	—	—	—	—	9	—	—	1	—	—	—	2
Senegal	9	9	—	—	—	—	—	—	—	—	—	—	—	—	9
Sierra Leone	9	9	—	—	—	—	—	—	—	—	—	—	—	—	9
Burkina Faso (U. Volta)	15	15	—	—	—	2	—	7	—	5	—	—	—	—	—
Zaire	7	7	—	—	—	—	—	—	—	7	—	—	—	—	—

Table B-2.—Number of IARC Senior Staff, Visiting Scientists, and Staff on Deputation, Posted in Each Country, 1982 or 1983[a]—continued

Country	Total	Scientists not in IARC's host countries	CIAT	CIMMYT	CIP	IBPGR	ICARDA	ICRISAT	IFPRI	IITA	ILCA	ILRAD	ISNAR	IRRI	WARDA
East and South Africa	***84***	***22***	—	***5***	***5***	—	***0***	***4***	***0***	***2***	***38***	***30***	***0***	***0***	***0***
Burundi	1	1	—	—	1	—	—	—	—	—	—	—	—	—	—
Ethiopia	33	1	—	—	—	—	—	—	—	1	32	—	—	—	—
Kenya	43	13	—	4	2	—	—	1	—	—	6	30	—	—	—
Malawi	1	1	—	—	—	—	—	1	—	—	—	—	—	—	—
Rwanda	2	2	—	—	2	—	—	—	—	—	—	—	—	—	—
Sudan	2	2	—	—	—	—	—	2	—	—	—	—	—	—	—
Tanzania	1	1	—	—	—	—	—	—	—	1	—	—	—	—	—
Zimbabwe	1	1	—	1	—	—	—	—	—	—	—	—	—	—	—
Latin America	***186***	***29***	***72***	***55***	***57***	***1***	***0***	***2***	***0***	***3***	***0***	***0***	***1***	***1***	***0***
Argentina	1	1	—	—	—	—	—	—	—	—	—	—	1	—	—
Brazil	6	6	4	—	1	—	—	—	—	1	—	—	—	—	—
Costa Rica	1	1	1	—	—	—	—	—	—	—	—	—	—	—	—
Chile	1	1	—	1	—	—	—	—	—	—	—	—	—	—	—
Colombia	67	5	62	1	2	1	—	—	—	—	—	—	—	1	—
Ecuador	3	3	—	3	—	—	—	—	—	—	—	—	—	—	—
Guatemala	2	2	2	—	—	—	—	—	—	—	—	—	—	—	—
Mexico	52	2	—	50	—	—	—	2	—	—	—	—	—	—	—
Paraguay	2	2	—	—	—	—	—	—	—	2	—	—	—	—	—
Peru	54	3	3	—	54	—	—	—	—	—	—	—	—	—	—
Others	***67***	***11***	***0***	***2***	***1***	***8***	***0***	***0***	***28***	***0***	***0***	***0***	***28***	***0***	***0***
Holland	1	1	—	—	1	—	—	—	—	—	—	—	—	—	—
Italy	6	6	—	—	—	6	—	—	—	—	—	—	—	—	—
Netherlands	28	—	—	—	—	—	—	—	—	—	—	—	28	—	—
Portugal	2	2	—	2	—	—	—	—	—	—	—	—	—	—	—
USA	30	2	—	—	—	2	—	—	28	—	—	—	—	—	—

[a] 1983 data for CIAT, CIMMYT, CIP, IBPGR, ICARDA, ICRISAT, IFPRI, ILCA, ILRAD, ISNAR, and IRRI; 1982 data for others.

SOURCE: Consultative Group on International Agricultural Research, "The CGIAR in Africa," Washington, 1984.

animal by-products—is incalculable. Both diseases are caused by parasites that are transmitted by insect vectors; the tsetse fly carries trypanosomes while ticks transmit theileriosis. In both cases, the relationships among parasites, hosts and vectors are subtle and complex; intervention is difficult. ILRAD's emphasis is to identify and exploit disease control methods that rely on the immunological responses of the host animals. ILRAD works with other institutions to pool animal disease and production skills toward the solution of livestock problems in Africa. For example, ILCA and ILRAD work together with ICIPE (the International Center for Insect Physiology and Ecology) in a Trypanotolerance Network to study relationships of the parasite, the vector, the animal, and animal management in livestock that have some tolerance to trypanosomiasis. ILRAD hosts staff of several other CGIAR centers, including ILCA, at its headquarters in Nairobi.

9. *WARDA* (the West Africa Rice Development Association), located in Monrovia, Liberia, is a regional organization to promote self-sufficiency in rice in 15 countries of West Africa. The CGIAR helps to support the research activities of WARDA. WARDA seeks to develop improved rice varieties adapted to the region's agroclimatic and social conditions, and to develop improved farming systems that are appropriate to improved rice varieties and to socio-economic and agricultural conditions of the region. The WARDA program concentrates on four systems of rice production—mangrove swamp rice (somewhat saline conditions), irrigated rice, upland (rainfed) rice, and deep water rice.

10. *IARCs With Programs Located in Africa.* In addition to the four centers whose headquarters are in African countries, seven other centers have staff stationed in Africa engaged in a variety of activities in cooperation with national research institutions. The seven are the Centro International de Agricultura Tropical (CIAT), the International Maize and Wheat Improvement Center (CIMMYT), the International Board for Plant Genetic Resources (IBPGR), the International Potato Center (CIP), the International Rice Research Institute (IRRI), and the International Center for Agricultural Research in the Dry Areas (ICARDA). All of these centers are working on a range of crops that are important staple foods throughout Africa.

11. *CIAT* (the International Center for Tropical Agriculture) with headquarters in Colombia, has responsibility for the world germplasm collection of cassava and, in cooperation with IITA, is involved in supplying germplasm for cassava improvement programs in Africa. It carries on similar work for the common bean in East Africa and is now building up a nine member team to work on bean improvement there. CIAT has a large tropical pastures program in Latin America and is working to develop relationships between it and forage research efforts in humid and subhumid zones of Africa, particularly with ILCA.

12. *CIMMYT* (the International Maize and Wheat Improvement Center) is headquartered in Mexico, but the center has a number of ongoing programs in Africa. Some of these programs are supported by bilateral donors, and most are run on a cooperative basis with national institutions. The CIMMYT Maize Program has had staff working in national programs in three African countries—Ghana, Tanzania, and Zaire. The oldest of these programs began in 1973. CIMMYT also has a joint African maize program with IITA, located at Ibadan, Nigeria. The Wheat Program has staff members assigned to the East Africa regional program which includes 17 countries, from Ethiopia in the north to Lesotho in the south. In addition, the Economics Program has a regional economist headquartered at ILRAD in Nairobi who works with national research programs in Kenya, Tanzania, Malawi, and Zambia. Training is an important part of CIMMYT's contribution to African agriculture; during the period 1971-83, 187 trainees from tropical Africa were involved in the maize in-service training course, while from 1966-83, 96 trainees were involved in wheat in-service training. CIMMYT also provides at its headquarters and field research sites in Mexico training opportunities for visiting scientists from Africa.

13. *IBPGR* (the International Board for Plant Genetic Resources), located in Rome, was established to promote an international network of genetic resources centers to further the collection, conservation, documentation, and use of plant germplasm. Although IBPGR provides services to national and international organizations, it also supports and encourages research in genetic resources by other IARCs and national programs. It works closely with other centers in the CGIAR system. The IBPGR has sponsored a number of collecting missions in various African countries, notably in West Africa, and, from time to time, has stationed staff in Africa over extended periods of time.

14. *ICRISAT* (the International Crops Research Institute for the Semi-Arid Tropics) has its headquarters in Hyderabad, India, but much of its work is applicable to, designed for, and takes place in, semi-arid areas of Africa. The two major cereal crops for which it is responsible, sorghum and millet, are major staples especially in West Africa, and groundnut is a major crop in many parts of the continent. In 1983 ICRISAT had scientists posted to Bukina (sic) Faso (Upper Volta), Kenya, Mali, Niger, Nigeria, and the Sudan.

ICRISAT's work in West Africa has, in the past, taken place within the national research programs and has been largely designed to facilitate transfer of technology from India. It has become apparent that the types of sorghum and pearl millet varieties that gained substantial acceptance in India were not adapted to the ecological conditions and farm family needs in West Africa. As a result ICRISAT has decided to establish a research subcenter for the difficult environment of the Sahel in which it would have the facilities and capability to carry out the complete range of research activities needed. The ICRISAT Sahelian Center, being located near Niamey, Niger, should serve the longer term needs of the region. ICRISAT is in the process of establishing a regional team at Bulawayo, Zimbabwe, to meet the needs of Southern Africa and a regional team in Kenya to meet the needs of Eastern Africa. Discussions are underway on the Center's involvement in a regional grain legume program for Southern and Eastern Africa. Between 1974 and 1983 ICRISAT provided in-service training to 210 researchers from West Africa, 103 from Eastern Africa, and 51 from Southern Africa; another 31 researchers from Africa were Research Fellows or Research Scholars.

15. *CIP* (the International Potato Center), located in Peru, maintains several staff members in East Africa. Potatoes are not very widely grown in most African countries, but are of increasing importance. A regional scientist is located at ILRAD in Nairobi. This scientist oversees the cooperative research and training activities in the area. Two staff members reside in Rwanda and one lives in Burundi; their responsibilities include research on potato in those countries. Other regional representatives are stationed in Egypt and Tunisia. CIP also supports work of local scientists in Ethiopia and Kenya. A country network, PRAPAC (Programme Regional d'Amélioration de la Culture de Pomme de Terre en Afrique Centrale), which includes Burundi, Rwanda, and Zaire was established in 1982. The network carries out research and training activities.

16. *IRRI* (the International Rice Research Institute), located in the Philippines, has a liaison scientist for the African region who is based at IITA in Nigeria and who works closely with WARDA and with national institutions. Because within the CGIAR system IITA has responsibility for research on rice in Africa, IRRI does not have a major direct presence in Africa but, through its International Rice Testing Program (IRTP), IRRI makes advanced rice materials available to WARDA and to various interested national institutions. IRRI has recently engaged in discussions of the feasibility of contracting for an outreach program in Madagascar which has rice production systems quite similar to those of Asia. Two scientists are in Egypt on a similar arrangement.

17. *ICARDA* (the International Center for Agricultural Research in the Dry Areas), located in Syria, has a program on faba beans (also known as broad or horse beans) in Egypt and the Sudan, and has stationed staff in those countries to help carry out the research. More recently, a research team has been stationed in Tunisia to work on barley and legume improvement with national research institutions in North Africa. ICARDA is developing working relations with ILCA in areas of livestock/crop production integration.

18. *Other IARCs That Work in Africa But Do Not Have Resident Staff in the Continent.* The remaining two centers do not have resident staff in Africa, but their work includes activities directly or indirectly related to Africa. The centers concerned are the International Service for National Agricultural Research (ISNAR), and the International Food Policy Research Institute (IFPRI).

19. *ISNAR* (the International Service for National Agricultural Research), located in The Hague, was organized in 1980 to assist developing nations to improve their national agricultural research capability. ISNAR has already been invited to assess the strengths and weaknesses of several national research systems in Africa, and has completed assessments of Bukina [sic] Faso (Upper Volta), Ivory Coast, Kenya, Madagascar, Malawi, Rwanda, and Somalia. ISNAR is deeply involved in a large project under the Cooperative Development for Africa Group to help upgrade agricultural research training.

20. *IFPRI* (the International Food Policy Research Institute), located in Washington, DC, works on policy issues relating to food and agriculture. IFPRI is devoting about 30 percent of its research to projects related to Africa, compared to about 18 percent during the past ten years. Published IFPRI Research Reports include studies on Food Security in the Sahel, Agricultural Research Policy in Nigeria and growth linkages in Nigeria (sic) and Kenyan agricultural exports. Proceedings of a major policy conference on accelerating growth in Sub-Saharan Africa is in the process of being published.

Impact of the CGIAR in Africa

21. A great deal of attention is being given by the CGIAR to the various African countries. As already mentioned, four of the centers are located in Africa, the largest number in any continent, and most of the others have stationed senior scientific staff to reside and work in various African countries. Research by the IARCs has already shown its relevance and use-

fulness for African agriculture, but adoption has been slowed by the general anti-agricultural policies of many African countries, the low level of infrastructure development, and the lack of inputs.

22. Improved maize lines from CIMMYT have helped to raise yields in Zaire and Tanzania, while IITA has developed maize lines with resistance to the devastating streak virus, and efforts are currently under way by a joint CIMMYT/IITA program to transfer streak resistance to local African maize cultivars. This will enable farmers to grow their accustomed local varieties while ensuring protection against the damaging streak virus disease.

23. CIP, in cooperation with national research institutions, has released potato varieties that yield well under farm conditions in Burundi, Ethiopia, Kenya, and Rwanda. In cooperative work with ILCA, CIP has obtained yields of 80 tons per hectare in the Ethiopian highlands; such yields could increase farm incomes dramatically.

24. WARDA has tested and released a number of improved rice varieties for its West African member countries. Significant potential improvements exist for irrigated and deep-water rice.

25. IITA has made significant progress in developing high-yielding cassava varieties that are resistant to the destructive complex of diseases and insects that attack cassava in Central and West Africa. Some of this work was done in cooperation with the national program in Zaire. IITA has also made major progress in biological control of damaging cassava pests, particularly the cassava mealybug. The IITA cassava improvement program is a good example of the need for long-term research in Africa on major intractable problems. IITA uses germplasm from CIAT's major cassava germplasm collection in its improvement work.

26. IITA has developed sweet potato lines that are very resistant to attack by the sweet potato weevil, a major cause of post-harvest losses in that crop. These resistant lines are protected naturally from such insect attack, and spraying of insecticides is not required.

27. IITA and ILCA have worked to develop and improve alley-cropping, a form of agroforestry in which arable crops are grown between rows of perennial tree crops that can be used for several purposes such as fodder, wood fuel, and green manure.

28. ILCA, working with ILRAD and ICIPE (the International Center of Insect Physiology and Ecology), has developed a network to improve research and the development of information on trypanotolerant livestock in Africa. The network, which concentrates not only on trypanotolerant cattle but also on tolerant sheep and goats, places major emphasis on improving research and development activities in national institutions, and will help to provide guidance and financial support for participating scientists and institutions. ILCA has also been successful in using milk cows for animal traction in the Ethiopian highlands, thus providing a potential for the dual use of these cows by small farmers.

29. The above are but a few of the activities and accomplishments of the IARCs in their work relating to Africa. Many other opportunities exist; to capitalize on them will require commitment to agricultural development by African governments and improved research and extension services.

Issues and Options

30. It is generally agreed by agricultural research authorities and development experts that African countries should devote more attention and give higher priority to agriculture. Production must be increased and productivity improved. Much needs to be done, including reinforcement of policies that provide better incentives for farmers and the development of more productive agricultural systems. Each African country needs to build up a strong technology through research, and effective extension and information services that can assist farmers to increase productivity. The IARCs can be a good resource for national institutions in meeting such needs. However, in most circumstances, the services provided by IARCs can be of good use only where effective national programs exist. The IARCs can and do play a role in strengthening national institutions, but other international and bilateral organizations must provide financial support and technical assistance. In recent years the World Bank has identified national agricultural research as an area that requires more investment in most developing countries. Other multilateral and bilateral organizations have reached similar conclusions and are also giving increased attention to this need.

31. It is clear that the IARCs are generating, and will continue to generate, improved agricultural technology for Africa. Such technology can be adopted more quickly and effectively by nations that themselves possess an effective agricultural support capability. Broad cooperation by national, regional and international or-organizations will be required to strengthen African institutions to the level needed, and at the pace required.

—CGIAR Secretariat
October 1984

Appendix C

“Rural Africa: Modernization, Equity, and Long-Term Development,” by Uma Lele; and “Facing Up to Africa’s Food Crisis,” by Carl K. Eicher

The preceding OTA report is not intended to be a comprehensive treatment of all the issues related to food production and agricultural development in sub-Saharan Africa. Other authors have addressed different sets of issues from their own perspectives.

Two important analyses of the problems faced by Africa follow. Uma Lele's article reflects her perspective as chief of development strategy for the World Bank and as an African. The article by Carl K. Eicher represents the thinking of an American academic with extensive experience in Africa.

Both articles were published in their present form in *Agricultural Development in the Third World*[1] in 1984. Lele's article first appeared in *Science* in 1981. Eicher's paper was originally published in *Foreign Affairs,* also in 1981. Both articles appear with the permission of the authors and publishers.

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[1] Carl K. Eicher and John M. Staatz (eds.), *Agricultural Development in the Third World* (Baltimore: The Johns Hopkins University Press, 1984), pp. 436-479.

Rural Africa: Modernization, Equity, and Long-Term Development

UMA LELE

INTRODUCTION

Within less than a decade Africa is facing a second severe food crisis. The poor crop can yet again be explained as a result of drought. But the continent's growing vulnerability to crop failures is by no means unexpected. In most African countries it appears to be part of a long-term trend. Data on African countries, especially for subsistence production, are too poor to permit precise estimates,[1] but annual rates of increase of major staple food crops in sub-Saharan African seem to have been about 2 percent during the 1960s and early 1970s, compared with almost 3 percent in Asia and over 3 percent in Latin America.[2] Productivity increases in hybrid maize in some selected areas, such as the highlands of Kenya, have been impressive. However, on the whole, increases in the production of major cereals and root crops—maize, sorghum, millets, and cassava—have come about through increases in the area under cultivation rather than through gains in productivity per unit of input. This is in sharp contrast to even South Asia, which is generally perceived as laggard in development but where substantial productivity gains were experienced in food crop production in the 1970s. Per acre yields of many subsistence food crops appear to have stagnated or even declined in many African countries, as, for instance, in Ghana, Mali, Nigeria, and Sudan.

Because of higher population growth, the annual rates of increase in production required to meet consumption needs by 1990 are also estimated to be higher for sub-Saharan Africa—about 4.4 percent, compared with 4 percent for Asia.[3] If present trends continue, Africa will increase its dependence on food imports both over time and relative to other developing continents. Undernourishment is expected to become far more widespread, even though alternatives to cereals and staples, such as bananas and other fruit, fish, and animal products, have been far more important sources of calories in many parts of Africa than in South Asia, which has a similar per capita income. Indices of ill health and infant mortality in Africa are already among the highest in the developing world and are not expected to decline significantly in the next decade.

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Compared with the poor performance of food production, export crop production has been more varied among African countries since independence. Production of cotton, tobacco, cocoa, and coffee rose significantly in some countries until the 1960s, but during the 1970s and early 1980s production of major export crops has either stagnated or declined in many countries.[4] Nigeria, for instance, became a substantial net importer of edible oils, of which it was previously a net exporter. Groundnuts in Mali, cocoa in Ghana, cotton in Sudan, and cotton, sisal, coffee, and cashews in Tanzania all provide examples of stagnancy or decline in production.

Rural-urban income disparities are already high in Africa, the ratios typically ranging between 1:4 and 1:9, compared with many countries in Asia, with ratios between 1:2 and 1:2.5. But because agricultural sectors have been stagnant or slow-growing even relative to the poorly performing industry and services sectors, these disparities are worsening in many cases. Kenya, Malawi, and Ivory Coast are the few exceptions where until recently economic growth has been impressive, but the distribution of benefits between agriculture and industry and within agriculture in these countries has been particularly unequal. The World Bank's *World Development Report 1981* estimates that per capita incomes in low-income African countries—countries where the annual per capita income is less than three hundred dollars—decreased 0.4 percent per year on the average during the 1970s, compared with a 1.1 percent annual increase in low-income Asia. Even the middle-income African countries experienced per capita income growth rates of only 0.4 percent per annum, compared with 5.7 percent in the corresponding countries in East Asia and the Pacific.[5]

Worse yet, prospects for overall economic growth in low-income Africa appear much poorer than in the rest of the developing world. The *World Development Report* projects the likely average annual growth rates of per capita income for the high case in low-income Africa during the 1980s to be only 0.1 percent, compared with 2.1 percent for low-income Asia. To reverse these long-term trends requires a clear understanding of the causes of poor past performance.

This chapter argues that most African countries are not giving priority to the development of peasant agriculture. There is not even much understanding of what is required to develop it. As a result, the domestic resources that are spent on agriculture go largely to pay for the growing wage bill of an inadequately equipped and inadequately operating public sector or to ineffective subsidies. The fragmented donor community has focused largely on project financing, mainly of capital expenditure and technical assistance. Project financing has been rapidly increasing over time, directed mainly toward the rural poor. Current and past donor investments are having little impact, however, not only in the short run but in laying the foundations for long-term development as well. The project approach often results in poor policies, a shortage of maintenance and operating funds, and a shortage of qualified staff, hence often a major depletion of capital.

The Asian experience suggests that agricultural development requires large amounts of resources. Donors should give special attention to broadening their support of education substantially and supporting not just primary but middle- and high-level of training of nationals in technical fields to develop a science-based peasant agriculture. This not only would help to create national policy, planning, and implementing capacity but would support a diverse network of institutions required for development, in addition to those operated by governments. Major investments are also needed in transport and communications, many of which will have to be highly capital-intensive. With such a reoriented emphasis, and guaranteed long-term assistance tied to concrete indications of national commitment, at least long-term prospects could improve significantly.

THE CRUCIAL ROLE OF PEASANT AGRICULTURE

As in many parts of low-income Asia, such as Nepal, Sri Lanka, India, Bangladesh, and Thailand, in Africa concern for economic development is primarily a concern about agricultural and rural development. Between 80 and 90 percent of the nearly 400 million people in sub-Saharan Africa live in rural areas. Most derive their subsistence from meager crop and livestock production and survive on annual per capita incomes of less than U.S. $150. Although production is geared largely to subsistence, the rural sector is also the major source of food for urban consumption and of raw materials for exports and for domestic manufacturing. Except in a few mineral-producing countries such as Zaire, Zambia, and Nigeria, agriculture constitutes the largest income-generating sector, contributing up to 40 percent of the gross national product of many African countries. Between 70 and 80 percent of the annual export earnings of many countries is derived from three to six agricultural commodities. Direct and indirect taxes on agriculture are the most important source of government revenues. Although the estate sector is an important producer of marketed surpluses of certain crops in certain countries, a major share of the total production and marketed surplus nevertheless comes from the smallholder sector. Not only is broad-based agricultural development thus crucial for increasing incomes, employment, and export earnings, but raising the incomes of the rural poor is essential for raising government revenues and creating a domestic market for the goods and services produced in a growing urban manufacturing sector.

POLICIES AND STRATEGIES SINCE INDEPENDENCE

The "Modernization Now" Approach

Rhetoric and plan documents in almost all African countries make reference to the key role of the agricultural and rural sector in Africa's modernization. Since the disastrous drought of 1973–74 self-sufficiency in food has become a major objective, often supported by donor-financed projects. The need for increasing export earnings is also being recognized more urgently, the balance of payments difficulties having grown with the rising cost of imported energy and manufactured goods. Despite the growing awareness and the increased number of projects, however, unlike in Asia, there is not yet the basic conviction among many African policy makers that the smallholder agricultural sector can and will have to be the engine of broad-based economic development and eventual modernization.

Modernization is taken to mean mainly industrialization and the commercialization of agriculture, largely through mechanized, large-scale farming. The fluctuating prices of primary exports explain the desire to industrialize, as does the relative ease of setting up factories and state farms compared with the organizationally far more demanding development of peasant agriculture. In its broadest sense the objective of modernization is, of course, shared extensively throughout the developing world. It is the short time perspective of the African expectations that poses a problem, especially given the much poorer institutional and trained manpower base that Africa inherited at independence. Goren Hyden aptly contrasts the eloquent Tanzanian President Nyerere's slogan "We must run while others walk" with China's strategy of modernization by the year 2000.[6] The frequently noted perception of peasant agriculture as a "holding sector" is, however, by no means unique to Africa. At an earlier stage, India's first five-year plan (1951–56) incorporated community development and promotion of cottage and small-scale industry essentially as stopgap arrangements to ensure rural welfare and employment until industrialization could absorb the growing pool of surplus agricultural labor.[7] The more dynamic development strategy, oriented toward small-farmer productivity, which is now being implemented successfully in many parts of India came into ascendancy only in the mid-1960s, with technological change made possible by the new high-yield cereals. As is argued below, in Africa the view of agriculture as a holding sector and the "Modernization Now" strategy have had many of the same consequences for the development of peasant agriculture in more free-enterprise, growth-oriented Nigeria and Zambia as in Ethiopia and Tanzania, which show greater concern about income distribution and class formation.

GOVERNMENT INVESTMENT IN AGRICULTURE

Planning the use of government finances for agricultural development is, of course, not easy for most African countries because of great fluctuations in their export earnings. Their bureaucracies are less experienced than those of their Asian counterparts, which experience similar fluctuations in earnings. Lately their ability to plan has been further eroded, as has that of other developing countries, by the declining purchasing power of their export earnings, as import prices of oil and industrial goods have soared. In constant dollars, the purchasing power of exports from fourteen principal countries in Africa fell by about 40 percent from 1973 to 1980.[8]

Even within these all too obvious constraints, however, far fewer resources are plowed back into agriculture by most African countries than would seem justified. Intercountry comparisons are exceedingly difficult, owing to definitional, data, and other measurement problems, but in the 1970s around 10 percent or less of the planned development expenditure was allocated to the agricultural sectors in Kenya and Mali, compared with 31 percent in India during its first five-year plan in 1951 and 20 percent of the much larger absolute investment in the subsequent three plans. In Zambia the total agricultural budget may have decreased in real terms by an annual average of slightly over 9 percent in the late 1970s, reflecting general budgetary cuts. Malawi is one of the few exceptions in Africa; it appears to have allocated close to 30 percent of the known planned public expenditures to agriculture. However, even there, because of the more favorable tax, wage, and pricing policies toward the estate sector, large-scale production has grown at an annual rate of close to 17 percent since 1968, with 70 percent of the share in exports. The corresponding production increase in the smallholder sector has been only 3 percent a year, even though services to peasant agriculture generally operate far more effectively in Malawi than in several neighboring African countries.

Large-scale farming per se is far less important a portion of total production or exports in Tanzania than in Malawi. However, government policies of "villagization" of peasant producers, combined with pronouncements of the need for cooperative cultivation and actual haphazard attempts to introduce it, have had an adverse effect on smallholder incentives and production. Several other seemingly well-motivated government initiatives to raise peasant productivity have ended up being poorly implemented. These have led, for instance, to unrealistically high production and input-use targets, the consequent indiscriminate promotion of fertilizer use, and discouragement of interplanting of crops (which is traditionally done by peasants to reduce risks of crop failure) as not being "modern." These government initiatives, combined with unreliable provision of agricultural extension, credit, and output marketing, rather than enabling producers to raise overall agricultural productivity, have resulted in producers' responding mainly to changing relative prices of food and export crops. The failed government initiatives have in turn led to an increased official tendency to look toward large-scale mechanized and irrigated production to guarantee food and export surpluses. Like Tanzania, many other countries have already invested or have plans to invest substantial resources in large-scale state farms, but the record of public-sector farming is very poor throughout Africa, and large subsidies are required for these operations.

Irrigation will have to become important ultimately, as the vast, less costly possibilities of increasing production under rain-fed conditions begin to be exhausted. For the short run, however, in most of Africa there is not the complex institutional and managerial capacity to operate irrigation systems indigenously. The frequently costly rehabilitation (at five thousand to fifteen thousand dollars per hectare) being undertaken in many of the existing schemes illustrates the problem.

INCENTIVES TO PEASANT PRODUCERS

Peasant agriculture is highly taxed by fixing low prices for its products and by overvaluing the national currencies vis-à-vis those of importing countries. Agricultural taxation helps keep urban food prices low and finances modernization through many capital-intensive investments, such as construction of new capital cities, stadiums, manufacturing and processing plants, and airports. Agriculture is, of course, the most important sector and hence has to be the major source of revenue. However, traditionally it was taxed because peasants were perceived as irrational, lazy, and unresponsive to price incentives. The resulting tax practices were inherited by independent governments from colonial administrations. Evidence of producer response has mounted, however. In turn, relative official producer prices of food and export crops have been changed in many countries in the last decade, first in order to achieve food self-sufficiency and more recently to promote exports. Relative prices have in fact been easier for governments to influence than technology or quality of services. Thus, while the composition of food and export crops has changed, overall productivity has stagnated. The producer's share in the total net market value of the output has frequently remained very low. In Sudan, the rate of taxation on cotton farmers reached 35 percent in the late 1970s; in Mali it ranged from 36 to 69 percent on cotton, 52 to 65 percent on groundnuts, and 23 to 63 percent on sorghum and millets. Even after allowance is made for the subsidies received by farmers on fertilizer and credit, the effective rate of taxation amounted to 24–61 percent for cotton and 48–65 percent for groundnuts in Mali.

Again, the inadequate recognition of producer incentives is by no means confined to Africa. Theodore W. Schultz's *Transforming Traditional Agriculture*, which included examination of the peasant irrationality hypothesis, was prompted by similar observations in developing Asia in the early post-independence period.[9] In Asia these attitudes, trends, and perceptions have been muted, however. In fact, an articulate pro-agriculture lobby has been created within most governments in Asia. What accounts for these differences? In comparison with Africa (with a few exceptions, such as Kenya), in most of Asia there has been greater overt discussion of policy issues, both domestically and between domestic and outside scholars. More widespread formal education and training of policy makers and administrators in Asia has been helpful, as has their greater exposure to the farming communities through longer practical work experience.[10] New technological possibilities and increased use of purchased inputs have also changed the perspective on price incentives. Now several rural development projects in Africa have gradually begun to produce a similar cadre of knowledgeable Africans in several countries, but their numbers are small because of government and donor policies to be described later.

A large part of the agricultural budget in many countries is spent on subsidies—over 70 percent in Zambia. But contrary to general opinion, many of the subsidies provided in the agricultural sectors in the hope of increasing overall peasant production do not compensate effectively for high rates of taxation. For instance, fertilizer subsidies frequently only help alleviate the high cost of production of inefficient domestic fertilizer plants or the high cost of their local distribution. General subsidies on interest rates and inputs largely benefit the already better-off commercial farmers.[11] A policy followed in many African countries of uniform pricing of output, involving complex cross-subsidies of transport and other handling costs across regions, has achieved regional equity, especially where few attractive enterprises exist, but has discouraged crop specialization to exploit different natural resources among regions.

INPUT AND OUTPUT MARKETING

Input and output marketing and processing facilities are almost always operated by semiautonomous government or parastatal agencies or by largely government-initiated cooperatives on a monopoly basis. Public marketing agencies tend to be high-cost operations because of overstaffing, poor financial control and accountability, and inexperienced management. If an informal traditional market operates, it is only tolerated rather than helped to improve.[12] Frequently it is actively discouraged. The eviction of largely Asian-dominated trade through Operation Maduka in Tanzania and the massive expulsion of Asians in Uganda illustrate the point. A strong desire to abolish exploitation of nationals by other races is understandable, even if such exploitation is imputed rather than real. But even Nigeria, which has a buoyant, largely indigenous small-scale traditional trading sector, adopted a policy of public-sector monopoly of the distribution of fertilizer. Tanzania has similarly discouraged its own enterprising tribes from trading, among other things by instituting some four hundred parastatals and over eight thousand village cooperatives, which are expected to provide most of the public services.

Some of these same policies are followed for almost the same political and bureaucratic reasons in most Asian countries, but the consequences there are far less severe. The degree of government control is more limited, there is greater administrative capacity to exercise it, and there has been more development of private institutions and transport and communication networks. In Africa, inputs are more frequently late, inadequately labeled and packaged, and in wrong combinations. Marketed surpluses are often not picked up on time, first payments to farmers are inordinately late, promised second payments rarely materialize, and damages to crops in storage and handling are extensive. Discouragement of private retail trade has affected rural supply of even the most basic day-to-day necessities in some countries, thus further reducing incentives for producers to consume, save, or invest. Institutional pluralism needs to be given major consideration as an element of development strategy in Africa.

AGRICULTURAL RESEARCH, EXTENSION, TRAINING, AND SOCIAL SERVICES

Whereas there is indiscriminate government intervention in some areas of policy, there is neglect of others, for instance, agricultural research, extension, and development of trained manpower. This neglect is due partly to inadequate recognition of the importance of these services and of the time required to establish effective institutions and delivery systems and partly to preoccupation with politically more expeditious short-run objectives. The role of donors in this regard should not be underrated and is discussed later. The diversion of scarce financial and manpower resources to purposes that the private sector could well be allowed to serve is also a handicap.

Because of the inadequate provision of recurrent resources, the research, extension, and training facilities that do exist are frequently underfinanced and poorly maintained. As President Nyerere observed in his famous speech "The Arusha Declaration: Ten Years After," the pressure to maintain and even expand public-sector employment is so high that the wage bill is difficult to control.[13] Consequently, there are not enough public funds for transport allowances for field staff to carry out research trials and extension demonstrations nor for spare parts, maintenance and operation of stores, processing facilities, research stations, vehicles, and roads. The general situation is one of ill-trained, unmotivated, unsupervised, and demoralized field staff in many sectors. Of course there are notable exceptions, such as the Kenya Tea Development Authority and the Agricultural Marketing Corporation in Malawi. Inadequacy and depletion of capital and government services over time are far more severe in areas where donor projects do not exist, inasmuch as these areas do not benefit from priority budgetary allocations. But the implementation of budgets also needs to be improved, as frequently even the resources allocated are not spent.

Social services suffer from many of the same problems. For example, lack or poor quality of water supply in many rural areas of Africa leads to ill health. Time spent in fetching water reduces time available for agricultural activities. Lack of health facilities similarly reduces labor productivity in agriculture. Absence of primary education results in limited access to services and employment opportunities in towns. Demand for social services is therefore widespread throughout Africa. On the other hand, public resources to pay the recurrent costs of providing social services are generally too limited to permit blanket coverage.

Either a high degree of selectivity or greater direct cost recovery is therefore required in the provision of such services. As many *harambee* ("self-help") schemes in Kenya illustrate, rural people are glad to contribute their own resources, provided the services are responsive to precise local demands and reliable, low-cost delivery is assured. Tanzania's example indicates, however, that for a combination of welfare and political reasons, governments refrain from cost recovery and genuine local involvement in planning and implementation. Tanzania's policy of universal provision of services through central financing has undoubtedly achieved results in some areas. According to official data, the proportion of the eligible population enrolled in primary schools went up from 28 percent in 1960 to over 90 percent in the late 1970s. The ratio of population with access to safe water has gone up from 13 percent in 1960 to about 40 percent in the 1970s. To a lesser extent, most African countries have expanded coverage of social services in a similar way, but the overall result is still inadequately financed services, with substantial demands on government resources.

Government objectives of modernization also exacerbate manpower shortages in the traditional sector. The low status of the traditional rural sector and the unattractive living conditions and facilities, in contrast to the urban or the large-scale agricultural sector, often deter qualified nationals from serving the needs of peasant agriculture. On the other hand, demand for education in Africa is one of the strongest in the developing world. The governments have allocated substantial portions of their own resources to education, with different emphases on primary and higher education, depending on their ideology. Because Tanzania has largely emphasized primary education, the enrollment ratio in secondary schools in Tanzania only went up from 2 percent at independence to 4 percent by the late 1970s, and from nearly zero to 0.3 percent in higher education. The shortage of middle- and higher-level technical and administrative manpower is consequently extremely severe. In Kenya, budgetary allocations to secondary and higher education have been expanding more rapidly, and private-sector expansion is permitted more liberally. As a result, 18 percent of the eligible population is enrolled in secondary schools and 1 percent is in higher education. Even then, middle- and higher-level manpower shortages are considerable, especially in technical fields such as accountancy, financial aid and physical resources management, agronomy, plant breeding, and mechanical and civil engineering. On a unit basis, skilled labor in African countries typically costs between three and ten times as much as in many Asian countries. The average annual salary of a research scientist in the 1970s was below ten thousand dollars in Asia, compared with thirty-four thousand dollars in East Africa.[14] And, of course, not nearly enough scientists are available even to rehabilitate, let alone to expand, the national research systems in Africa.

To summarize, the "Modernization Now" objective and the consequent national policies, investment priorities, and attitudes toward smallholder agriculture explain the poor performance of the agricultural and rural sectors in many African countries. In contrast, the Asian and, to a very limited extent, the African experience indicate that greater trained manpower, combined with longer developmental experience by nationals, leads to a better time perspective on modernization and more support of peasant agriculture.

AFRICA'S SPECIAL CHALLENGES

The frequent comparisons with low-income Asia in the previous discussion should not lead one to overlook the problems peculiar to Africa. Low rainfall, poor soils, and the highly diverse ecological conditions within individual countries make raising agricultural productivity much more difficult in many parts of sub-Saharan Africa than in Asia, with its extensive scope for small- and medium-scale irrigation and its more fertile soils.

Several seemingly favorable natural features of Africa, such as the low density of population, pose difficult rural development problems in the short run. In the late 1970s, population densities ranged from 6 persons per square kilometer in Somalia and Sudan to 90 in Nigeria. This is in contrast to a density of 155 in the Philippines, 200 in India, and 620 in Bangladesh. Farms are considerably larger and landlessness is less prevalent in Africa than in most Asian countries. However, extensive land use is itself a result of the unreliable and low rainfall and poor soils referred to above, which lead to shifting cultivation and widespread nomadism in many parts of Africa. Low density also makes for much higher per capita costs of providing roads, schools, and agricultural services in Africa than in Asia.

There are also apparent contradictions. In the African farming system seasonal labor shortages are a far more limiting factor in increasing productivity than in Asia, especially in view of the low level of African agricultural technology. Thus, selective use of mechanization in the private sector may be economically justifiable. And yet unemployment and underemployment of rural labor are also increasing, particularly where population pressure on land is rising rapidly. With rising fuel costs, mechanization—now often operated through the public sector—is frequently highly uneconomical. The more intermediate forms of technology that are used extensively in Asia, such as the ox plow, would be far more efficient where the tsetse fly has been controlled.[15]

Cattle are an important element of Africa's agriculture. The tradition of individual ownership of cattle, combined with communal grazing rights, has resulted in overgrazing and declining productivity. For decades technicians have stressed the need for destocking and pasture improvement, but these have proved elusive because of the complex sociocultural and environmental factors that operate in nomadic social systems and the absence of more profitable and less risky ways of investing the surplus resources of cattle owners.

Low population density also explains the extreme inadequacy of roads, railways, and waterways, although even in this respect there is considerable diversity. Small countries with greater population density, such as Kenya and Malawi, are less hampered by inadequate transport than are large countries such as Sudan, Somalia, Ethiopia, and Tanzania. And yet investments in the road system have also been greater in Kenya and Malawi than in many other African countries. Road mileage per square mile of land area is only 0.02 in Sudan, 0.1 in Zambia, and 0.15 in Zaire, compared with 0.23 in Kenya and 0.31 in Malawi.

Limited growth of sedentary cultivation has also meant more limited evolution of indigenous technology and skills in blacksmithing, carpentry, crafts, manufacturing, and trading than is typical of most Asian countries, though there are distinct differences between the more developed West African societies and those of East Africa. The range of farm implements, ox plows, and animal-driven modes of transport used extensively in other parts of the developing world are not prevalent even today in much of traditional rural Africa. On the contrary, with the advent of colonialism there was a "technological leap" toward tractors, combine harvesters, and modern means of transport, so that at independence Africa was left with greater technological dualism than was prevalent in most of colonial Asia.

For these various reasons, the challenges to agricultural research systems in Africa are by far the greatest in the world, combining constraints posed by ecological, demographic, technical, and institutional factors.[16] International agricultural research institutes such as the International Institute of Tropical Agriculture in Nigeria and several others, financed by the Consultative Group on International Agricultural Research, have already begun to address some of these problems. However, substantial additional investment is required in scientific research at the national and regional levels to develop profitable technological packages to suit the highly diverse conditions and reduce the risks now encountered in their adoption by low-income farmers. In some extremely marginal areas, such as parts of the Sahel in the north and Lesotho in the south, it may not be possible to increase productivity in present subsistence crops enough to make them a primary source of livelihood. Alternatives, including migration to more productive areas where labor-intensive, high-value horticultural crops can be produced, may have to be examined. These are costly options demanding considerable organization.

The situation with respect to trained manpower can be best appreciated by some comparisons with Asia at the time of independence. In 1960 even the educationally most advanced African countries, Ghana and Nigeria, had only 4 percent of the population of secondary-school age enrolled in school, compared with 8 percent in Bangladesh, 10 percent in Burma, 20 percent in India, and 26 percent in the Philippines. By the late 1970s the percentage in Nigeria had gone up to 13; by then it was 23 for Bangladesh, 22 for Burma, 28 for India, and 56 for the Philippines.

However, as may be seen in Ghana, Uganda, and Ethiopia, which have been better endowed with trained manpower than other African countries, without a conducive political environment little development is possible even with trained manpower. Many African countries have not yet fully achieved national unity or gained domestic political stability, the colonial powers having established national borders without regard to traditional land rights and tribal cohesion. Resources and attention sorely needed for rural development have often been diverted to internal conflicts, border wars, and maintenance of domestic political control.

Development of administrative capability will also take a long time. At independence, often there was a virtual absence of strong national, regional, and local government administrations of the types that existed in South Asia. Colonial agricultural development policies were geared almost exclusively to the expansion of export crop production for the metropolitan countries. Research was largely concentrated on export crops.[17] Agricultural extension, input supply, credit, and marketing and processing facilities were also highly fragmented. Recent efforts—for example, in Tanzania and Kenya—to decentralize administrative systems to make them more responsive to rural people's needs, while justified in the long run, have only exacerbated administrative weaknesses in the short run because the existing administrative manpower has had to be spread thinly between the central ministries of agriculture and transport and the provincial administration.

Africa thus starts with considerable odds against development. And yet there is immense potential for productivity increases, not simply in Sudan and the highlands of eastern and southern Africa, where it is commonly recognized, but in much of the rest of Africa, in the humid and semihumid tropics and the parts of the savanna that receive adequate rainfall.

THE DONOR'S ROLE

The experience of Asian countries indicates that in addition to providing direct financial support, international assistance can play an important role in the long run by increasing national consciousness about peasant agricultural development, by improving the rationale for policies, by making the effect of alternative policy options on different sectors or income groups more explicit, and by gradually strengthening those national forces that can lobby for policy changes. Changing the distribution of basic assets or political power so that, for instance, cooperatives will effectively include the poor and subsidies will not go to the rich is far more difficult to achieve from outside. National will and capacity are needed to this end.

Concern and debate about the equity issue in the international donor community have been extensive since the "green revolution" and the perceived failure of the trickle-down approach to reach the poor.[18] Since the world food crisis of 1973–74 the objective of national self-sufficiency in food, and subsequently a broader set of issues such as assurance of basic needs, environmental protection, and women's rights, have begun to receive international attention. The seemingly long time required to achieve the green revolution in Asia has created impatience in the donor community to achieve results, and with the widening scope of the development debate, the areas for achieving results have broadened.

Aid in the form of grants and low-interest loans has increased substantially over time in Africa. For the late 1970s, aid ranged between $20 and $40 a year per capita in Sudan, Kenya, Tanzania, Burundi, Ivory Coast, Mali, Cameroon, Zambia, and Malawi to as high as $50 to $120 in the smaller countries of Botswana, Lesotho, and Swaziland.[19] In many countries it constitutes a quarter or more of the total annual investment and over half the investment in agriculture and rural development. Even Bangladesh, which is one of the largest recipients of aid in Asia, received only about $10 of concessional aid a year per capita in the late 1970s.

Large numbers of aid agencies are involved in assistance to Africa, with relatively little coordination as to objectives, strategy, degree of continuity, and areas of assistance. Coping with the complex and differing procedures and large flows of aid is exceedingly difficult for the inadequately staffed bureaucracies of most African countries.[20]

Apart from targeting more donor-financed projects toward the rural poor, there has been much evolution in the concept of project assistance in recent years.[21] Projects no longer focus solely on export crops, but are increasingly concerned with development of food crops for domestic consumption. They are more strongly geared to institution building, such as strengthening the project-planning and implementing capacity of the national ministries of agriculture, of the provincial, regional, district, and local administrations, and of the financing and marketing entities that provide field services. This is in contrast to the earlier approach of "enclave" projects, which were implemented mainly through separate autonomous entities created for the purpose. The new projects also show greater concern for employment, training of local staff, and the use of local materials and techniques. They also anticipate more explicitly the need for recurrent financing and for financing of several time phases. They are also more likely now to include support for policy units and monitoring and evaluating to ensure greater flexibility and learning by doing.

Despite these major improvements, donor-financed projects are having a very limited impact, especially in light of the resources expended. This holds irrespective of whether their achievements are judged by inputs, such as numbers of local and expatriate staff recruited, research trials carried out, amounts of fertilizer and other inputs distributed, vehicles purchased, buildings and roads constructed or maintained, or amount of data collected or analyzed by evaluation units; or by the end results, such as increases in yields, numbers of staff trained, or administrative and financial procedures instituted.

What explains the limited impact? The gulf between the donors' largely equity-oriented objectives and the national government's goal of modernization has remained wide in Africa. Instead of examining the actual policies, strategies, and institutional frameworks of national governments and assessing the extent to which they are conducive to rural development, donors have largely taken government rhetoric and plan documents as indications of national commitment and priorities. Donors have concentrated on project aid as a way of influencing these priorities; in so doing, they frequently have exacerbated the problems of Africa's rural development in a variety of ways.

First, the simultaneous shift by much of the international community to the alleviation of rural poverty, in the face of obvious shortages of national manpower, resources, and institutional capacity, has led to underutilization and poor maintenance of donor investments. For a variety of reasons, donors have generally preferred to finance mainly capital expenditures, that is, equipment and civil works, rather than the recurrent expenditures required to maintain or operate these and other related investments.

Second, despite much evolution in the right direction, the need for assistance in increasing national capacity for policy development has been underrated. In addition, a number of questionable showpiece investments by governments have been made possible by generous financial support from the donor community. There are a number of reasons for such assistance: a wish to respond to national desires; an expectation of quick, visible results; the promotion of exports from donor countries; the vying among donor agencies to finance projects likely to appeal to their own domestic constituencies; the donors' need to meet their own quotas of assistance; and some understandable errors in judgment. However, there are other factors: the first relates to the provision of technical assistance in the short run, the second to the expansion of secondary and higher-level education to help broaden the capacities of nationals over the long run.

According to some estimates, as much as 75 percent of the technical assistance used in the developing world is used in Africa. In the short run, technical assistance has permitted the planning and implementation of development projects on a scale that would not have been possible otherwise. However, expatriates are becoming less acceptable in sensitive managerial or policy-making positions in most African countries. Their numbers have been growing for more than a decade since independence, mainly in technical and advisory positions. Their high salaries and benefits create resentment among nationals. Even when highly qualified in their specialties, they are not generally effective in working in an alien environment.

Increasing high-level education and training of nationals is therefore critical for augmenting Africa's managerial and policy-making capacity, even though the results will take a long time to achieve. Expansion of basic, primary, vocational, and adult education has been supported strongly by donors as a way of increasing the supply of field staff, meeting the basic-needs objectives, and increasing the receptivity of rural populations to agricultural and other innovations. Some high-level technical training of Africans is also being undertaken by several bilateral donors, such as the U.S. Agency for International Development and the British Overseas Development Ministry, which have traditionally supported this activity. But on the whole, expansion of secondary and higher education has not received the priority it requires from donors. Frequently the shortage of people with the necessary educational qualifications is so great that even those funds that are provided by donors for higher-level on-the-job training remain unused.

The gains to be had from basic, adult, and primary education are undoubtedly considerable, as evidence from Asia indicates. It is also clear, however, that in Africa at present the shortage of educated and technically trained cadres of nationals who can devise effective national strategies and policies is a far greater constraint to the alleviation of rural poverty than is the illiteracy or lack of receptivity of the rural population. Once again, the question is one of balance and priorities at a given stage of development. Evidence, mainly from Asia and Latin America, has also led to anxiety about increasing the ranks of the educated unemployed in developing countries. The perceived indifference of some of the educated urbanites to the largely rural needs of their own countries has led the international community to a general disenchantment with higher education. Perhaps implicit in this is the feeling that in comparison with the need to train lower-level staff, expanding the supply of high-level educated personnel is unnecessary or antithetical to the egalitarian objectives of rural poverty alleviation.

Contrary to these perceptions, an increase in the supply of educated personnel would not only improve national systems but also reduce salaries of the educated, including those of teachers, thus reducing income inequalities as well as the cost of further investment in education and a range of other development activities. By far the most unquestionable though unquantifiable benefit of higher education to Africa would be that of learning by doing, which is now lost to the ever-growing and changing expatriate technical community. It is ironic that most African countries do not have the capacity to propose alternative plans to those presented by donors for using aid funds—plans that would reflect the countries' own long-term needs for higher education.

The need for substantial investment in physical infrastructure in larger countries such as Sudan and Tanzania and in landlocked countries such as Zambia also requires critical examination by donors. Maintenance of past infrastructure has frequently been neglected, and not enough resources have been devoted to development of trunk roads, railways, and waterways by national governments and donors. Feeder road development has received considerably more support, but the lack of an effective national transport network makes investment in feeder roads ineffective. Again, some of the same reasons that apply to education and training explain this neglect, in particular the perception that capital-intensive infrastructure is not so necessary for reaching the poor, especially in the short run. A more appropriate balance between the objectives of immediate alleviation of poverty and the long-term development needs of more resource-intensive investments is required.

IMPLICATIONS FOR LONG-TERM DEVELOPMENT

The problem of Africa's rural development is not one of not knowing in broad terms what needs to be done to support peasant agriculture. The prospects for turning the present gloomy trends around are considerable. At the national level, the most fundamental problems are attitudes and vested interests. The subsistence rural sector must be seen as critical for economic development and must be given the priority that it urgently requires. At the international level, it is evident that current donor approaches of project aid, although perhaps far more essential in Africa than in many countries in Asia, are by themselves not enough to deal with Africa's complex developmental needs. A major reconsideration of the balance of assistance, including the donors' role in education, infrastructure, and long-term policy planning and implementation, is required. Only then can there be a useful discussion of development priorities with nationals. The question of reordering priorities will require a major review by the donor community as a whole, and even if the question is resolved adequately, the reordering of priorities will take at least a decade to show major results. But the prospects for the 1990s will then be considerably better than those for the 1980s. It is also the only way to reduce Africa's growing dependence on outside aid.

NOTES

I thank H. S. Bienen, W. V. Candler, J. M. Cohen, S. D. Eccles, A. O. Falusi, L. S. Hardin, G. Hyden, N. Islam, W. A. Lewis, J. W. Mellor, M. Mensa, T. W. Schultz, and two unknown reviewers for *Science* for comments on earlier drafts. The views expressed in the article are my own and do not necessarily represent those of The World Bank.

1. Uma Lele and Wilfred Candler, "Food Security in Developing Countries: National Issues," chapter 14 in this book; International Food Policy Research Institute, *A Comparative Study of FAO and USDA Data on Production, Area, and Trade of Major Food Staples*, Research Report no. 19 (Washington, D.C., October 1980).
2. International Food Policy Research Institute, *Food Needs of Developing Countries: Projections of Production and Consumption to 1990*, Research Report no. 3 (Washington, D.C., December 1977), table 3, p. 33.
3. Ibid., table 1, p. 22.
4. K. Anthony; B. F. Johnston; W. O. Jones; and V. Uchendu, *Agricultural Change in Tropical Africa* (Ithaca: Cornell University Press, 1979).
5. World Bank, *World Development Report 1981* (New York: Oxford University Press for the World Bank, 1981), table 1.1, p. 3.
6. Goren Hyden, in *Papers on the Political Economy of Tanzania*, ed. K. S. Kim, M. Mabele, and M. J. Schultheis (Nairobi: Heinemann, 1979), 5–14.
7. See Holdcroft, chapter 3 in this volume.—Ed.
8. The countries are World Bank members with populations over two million, plus Mauritius.
9. T. W. Schultz, *Transforming Traditional Agriculture* (New Haven: Yale University Press, 1964). [See also the discussion of Schultz's work in chapter 1 of this book.—Ed.]

10. Journals such as the *Economic and Political Weekly* have provided an important forum for a vigorous domestic discussion of planned priorities in India in which innumerable external analysts have participated.

11. Uma Lele, "Cooperatives and the Poor: A Comparative Perspective," *World Development* 9 (1981): 55–72. [See also Adams and Graham, chapter 21, and Gonzalez-Vega, chapter 22, in this volume.—ED.]

12. "There is no official policy towards the unofficial market," a comment of a senior official of one of the African ministries of agriculture, states the problem well.

13. Goren Hyden, *Beyond Ujamaa in Tanzania: Underdevelopment and an Uncaptured Peasantry* (Berkeley and Los Angeles: University of California Press, 1980), 133; Uma Lele, *The Design of Rural Development: Lessons from Africa*, 2d ed. (Baltimore: Johns Hopkins University Press, 1979).

14. P. Oram, *Current and Projected Agricultural Research Expenditures and Staff in Developing Countries*, International Food Policy Research Institute Working Paper, no. 30 (Washington, D.C., 1978), 6.

15. The tsetse fly is the vector of trypanosomiasis, or sleeping sickness, which is endemic in many parts of sub-Saharan Africa.—ED.

16. H. Ruthenberg, *Farming Systems in the Tropics* (Oxford: Clarendon, 1976). See also Schultz, chapter 23; Evenson, chapter 24; and CIMMYT Economics Staff, chapter 25, in this volume.

17. See Evenson, chapter 24 in this volume.—ED.

18. See chapter 1 in this volume.—ED.

19. World Bank, *Accelerated Development in Sub-Saharan Africa: An Agenda for Action* (Washington, D.C., 1981).

20. See Eicher, chapter 31 in this volume.—ED.

21. Lele, *The Design of Rural Development*.

Facing Up to Africa's Food Crisis

CARL K. EICHER

The most intractable food problem facing the world in the 1980s is the food and hunger crisis in the forty-five states in sub-Saharan Africa—the poorest part of the world.[1] Although the crisis follows by less than a decade the prolonged drought of the early 1970s in the Sahelian states of West Africa, weather is not the main cause of the current dilemma.[2] Nor is the chief problem imminent famine, mass starvation, or the feeding and resettling of refugees. Improved international disaster assistance programs can avert mass starvation and famine and assist with refugee resettlement. Rather, Africa's current food crisis is long-term in nature, and it has been building up for two decades; blanketing the entire subcontinent are its two interrelated components—a food production gap and hunger. The food production gap results from an alarming deterioration in food production in the face of a steady increase in the rate of growth of population over the past two decades. The hunger and malnutrition problem is caused by poverty: even in areas where per capita food production is not declining, the poor do not have the income or resources to cope with hunger and malnutrition.

Twenty of the thirty-three poorest countries in the world are African (World Bank 1982).[3] After more than two decades of rising commercial food imports and food aid, the region is now experiencing a deep economic malaise, with growing balance-of-payment deficits and external public debts. The world economic recession has imposed a severe constraint on Africa's export-oriented economies. Prospects for meeting Africa's food production deficit through expanded commercial food imports thus appear dismal. Donors have responded to these difficult problems by increasing aid flows to the point where African countries now lead the list of the world's aid recipients in per capita terms.[4] Furthermore, the World Bank report *Accelerated Development in Sub-Saharan Africa* (1981)[5] advocates a doubling of aid to Africa in real terms by the end of the 1980s. But the crisis cannot be solved through crash food production projects or a doubling of aid. Since the food and hunger crisis has been in the making for ten to twenty years, solutions to the crisis cannot be found without facing up to a number of difficult political, structural, and technical problems over the next several decades.

Key questions and policies that must be examined include: What is the record of agrarian capitalism and socialism? Why did the green revolution by-pass Africa? What lessons have been learned from crash food production projects in

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the Sahel and the development strategies of the 1970s—integrated rural development, helping the poorest of the poor, and the basic needs approach? Are technical packages available for small farmers to step up food production in the 1980s? Can foreign aid assist in the alleviation of the food production crisis and economic stagnation?

OVERVIEW OF AFRICA'S ECONOMY

Despite the fact that Africa is an extremely diverse region, several common features frame the boundaries for addressing its food crisis. First, population densities in Africa are extremely low relative to those in Asia. The Sudan, for example, is two-thirds the size of India, but it has only 18 million people as compared with 670 million in India. Zaire is five times the size of France and has only a small percentage of its arable land under cultivation. But some countries are near their maximum sustainable population densities, given present agricultural technology and available expertise on soil fertility. Much of the arable land in Africa is not farmed because of natural constraints such as low rainfall and tsetse flies, which cause human sleeping sickness and virtually preclude the use of approximately one-third of the continent, including some of the best-watered and most fertile land.[6]

Second, most of the economies are open, heavily dependent on international trade, and small: twenty-four of the forty-five countries have fewer than 5 million people, and only Nigeria has a gross domestic product larger than that of Hong Kong (World Bank 1981, 2). Small countries have special problems in assembling a critical mass of scientific talent and in financing colleges of agriculture and national agricultural research systems.

Third, all but two African states—Ethiopia and Liberia—are former colonies.[7] The colonial legacy is embedded in the top-down orientation of agricultural institutions and the priority given to medicine, law, and the arts rather than agriculture in African universities and partially explains the low priority that African states have assigned to agriculture and to increasing food production over the past twenty-five years.

Fourth, Africa is an agrarian-dominated continent where at least three out of five people work in agriculture and rural off-farm activities. Moreover, since agricultural output accounts for 30–60 percent of the gross domestic product in most countries, the poor performance of the agricultural sector over the past two decades has been a major cause of poverty and economic stagnation.

Fifth, Africa's human resource base is extremely weak relative to those of Asia and Latin America. In most countries, even after twenty years of independence, there are still only small pools of agricultural scientists and managers because of the token priority that colonial governments gave to educating Africans.

PROFILE OF AFRICAN AGRICULTURE

Although there are more than one thousand different ethnic groups in Africa and wide differences in farming and livestock systems by agroecological zones, the following overview pinpoints the major features of African agriculture and some of the differences between it and agriculture in Asia and Latin America.[8]

For the most part, land ownership in Africa is remarkably egalitarian as contrasted with that in Latin America. The uniform agrarian structure is partially a function of colonial policies that prohibited foreigners from gaining access to land in some parts of the continent, such as West Africa. But in Zambia and Zimbabwe, colonial policies promoted a dual structure of large and small farms (Blackie 1981).

Empirical research has shown that African farmers, migrants, and traders are responsive to economic opportunities. Although custom, local suspicions, jealousies, ignorance, and fatalism can play a role in inhibiting the introduction of change in a particular situation, these variables do not serve as a general explanation of rural poverty (Jones 1960).

Africa is a region of family-operated small farms, in contrast to Latin America, where land ownership is highly concentrated. The typical smallholder has five to fifteen acres under cultivation in any one year and frequently has as much or more land in fallow in order that soil fertility can be gradually restored. Thus, it is more accurate to describe most African farming systems as land-extensive farming systems rather than land-surplus systems. The typical smallholder gives first priority in terms of land preparation, planting, and weeding to growing staple foods (such as millet, sorghum, yams, cassava, white maize, and beans) to feed his family and second priority to producing cash crops such as coffee, cotton, and groundnuts for the market.

Family labor supplies the bulk of the energy in farming, unlike in Asia, where the main energy source is oxen. The short-handle hoe and the machete are the main implements used in land preparation and weeding. Rural nonfarm activities account for 25–50 percent of the total time worked by male adults in farm households over the course of a year in Africa. Unlike in Asia, there is no landless labor class in most African countries because of the presence of idle land.

Land tenure in Africa can be characterized as a communal tenure system of public ownership and private use rights of land (Cohen 1980). The combination of private use rights and communal control over access to land allows families (*a*) to continue to farm and graze the same land over time and to transfer these use rights to their descendants and (*b*) to have the right to buy and sell rights to trees (such as oil palm and cocoa) through a system of pledging. There is no active rural land market in most countries. Land tenure and land use policy issues will be of strategic importance in the 1980s and 1990s as the frontier phase is exhausted, land markets emerge, irrigation is expanded, and herders shift from nomadic to seminomadic herding and sedentary farming systems that integrate crops and livestock.

Unlike in Asia, where two or three crops are grown sequentially over a twelve-month period, most African farmers produce only one crop during the rainy season and engage in some form of off-farm work during the dry season. Irrigation is a footnote in most countries because farmers can produce food and cash crops more cheaply in rainfed farming systems.

Rural Africa is at a crossroads. Farming and livestock systems are complex, heterogeneous, and changing. African villages are experiencing major changes in response to the penetration of the market economy, drought, explosive rates of population growth, and the oil boom in countries such as Nigeria and Gabon. For example, the oil boom in Nigeria has escalated rural wage rates, induced migration from northern Cameroon and Niger, and provided a market for livestock and food crops from neighboring countries.

The subsistence farmer producing entirely for his family's consumption is hard to find in Africa today except in special cases where inadequate transport, rebellion, or political unrest have forced farmers to withdraw from the market and produce for their subsistence needs (such as in Uganda and Guinea in the 1970s and in Tanzania in the early 1980s). In the 1980s and 1990s, village institutions will be under pressure as rural Africa shifts from extensive to intensive farming and livestock systems in response to the decline in the ratio of land to labor. Inequality between countries—for example, Upper Volta and the Ivory Coast—and within countries—for example, southern and northern Sudan—will likely increase in the coming decades.

UNDERDEVELOPED DATA BASE

Africa has a weak and uneven data base, and there is a need to interpret official statistics with caution. For example, accurate data on acreage under cultivation and yields are available for only a handful of countries. Estimates of land under irrigation vary from 1 percent to 5 percent. Estimates of the size of national livestock herds are notoriously suspect because of cattle tax evasion. Even trade data must be carefully examined. For example, official data on cocoa exports from Togo in the 1970s included a large volume of cocoa from Ghana which was smuggled into Togo. Data on rural income distribution are available for only a few countries. Agricultural statistical agents in most countries rely heavily on guesstimates from extension agents, and they have been known to revise their figures to bring them into line with published estimates from international agencies. The combination of underdeveloped data and the case study nature (village studies, for example) of much of the research in the past decade makes it difficult to generalize about the sources of agricultural output and the causes of poverty, malnutrition, and lagging food production.

There is also a need to beware of the pitfalls of studies that present the results of survey research, such as farm management and nutrition surveys, in terms of averages. For example, data showing that farmers produce enough food to feed each family member an average of two thousand calories a day during a given year are meaningless if some family members do not have enough food to survive during the "hungry season." Moreover, the use of averages promotes the view that there is a homogeneous or classless rural society and that interventions designed to improve the average incomes in an area will automatically improve the incomes of all people, including those on the lower end of the income scale. Numerous researchers have shown that rural inequality is an integral part of Africa's history, that inequality may increase as a result of technical change, and that assistance to particular groups of people will have to be carefully targeted.

In summary, although a few scholars talk glibly about average sorghum yields for a country, the "African case," and uncritically use Africa-wide figures (for example, that women produce at least 80 percent of the food in Africa), serious scholars wisely eschew generalizing about even a subregion such as West Africa—an area as large as the continental United States.

FOOD AND POPULATION TRENDS

Looking at Africa's food production trends, population growth, food imports, and poverty, the overriding pattern emerges clearly: since independence Africa's historical position of self-sufficiency in staple foods has slowly dissipated (FAO 1978). Over the 1960–80 period, aggregate food production in Africa grew very slowly—by about 1.8 percent per year, a rate below the aggregate growth rate of Asia or Latin America. However, the critical numbers are not statistics on total food production but per capita figures. The U.S. Department of Agriculture (1981) statistics show that sub-Saharan Africa is the only region of the world where per capita food production declined in the 1960–78 period. In addition, the average per capita calorie intake was below minimum nutritional levels in most countries.[9]

The per capita figures reflect the fact that Africa is the only region of the world where the rate of growth of population actually increased in the 1970s. The annual population growth rate in Africa was 2.1 percent in the mid 1950s and 2.7 percent in the late 1970s and is projected to increase throughout the 1980s until it levels off at about 3 percent by the 1990s (United Nations 1981). Underlying the upward population trend is a young age structure. The average African woman produces six living children in her reproductive years.

There is little hope for reducing fertility levels in the 1980s because of a complex set of factors, including the economic contribution of children to farming and rural household activities, the pro-fertility cultural environment, the failure of family planning programs to date, the pro-natal policies of some states, such as Mauritania, and the indifference of most African heads of state and intellectuals to population growth in what they consider to be a land-surplus continent. But explosive rates of population growth cannot be ignored much longer. For example, Kenya's annual rate of population growth of more than 4 percent implies a doubling of population in about seventeen years (Kenya 1981). In Senegal, where 95 percent of the population is Muslim and the Muslim leaders have great political power, the government is moving gradually on population intervention as it expands demographic research and quietly opens child and maternal health clinics in urban areas. In sum, for a variety of reasons, it is almost certain that most states will move slowly on population-control policies during this decade. As a result, population growth will press hard on food supplies, forestry reserves, and livestock and wildlife grazing areas throughout the 1980s and beyond.

Food imports are another important dimension of the critical food situation. Many countries that were formerly self-sufficient in food significantly increased their ratio of food imports to total food consumption in the 1960s and 1970s. According to USDA figures, food imports are dominated by grain imports—especially wheat and rice—which have increased from 1.2 million tons a year in 1961–63 to 8 million tons in 1980, at a total cost of $2.1 billion. Significantly, commercial imports of food grain grew more than three times as fast as population over the 1969–79 period. Rising food imports are attributed to many factors: lagging domestic production; structural and sectoral shifts arising from such factors as the oil boom in Nigeria and the increase in minimum wages in Zimbabwe following independence; increasing urbanization; the accompanying shift of consumer tastes from cassava, yams, millet, and sorghum to rice and wheat; availability of food aid on easy terms; and overvalued foreign exchange rates, which often make imported cereals cheaper than domestic supplies. Although data on food aid are imprecise, food aid represented about 20 percent of Africa's total food imports in 1982. Wheat, wheat flour, and rice dominate overall imports.

Given the intimate linkage of hunger and malnutrition to poverty, economists, nutritionists, and food production specialists are coming to agree that food and poverty problems should be tackled together. For if rural and urban incomes are increased, a large increment of the increased income of poor people (50–80 percent) will be spent on food.[10] Unless food production is stepped up, an increase in rural and urban incomes will simply lead to increased food prices and food imports and a hardship on families in absolute poverty. Conversely, while expanded food production should be the centerpiece of food policy in Africa in the 1980s, food policy strategies must go beyond crash food production campaigns to deal with poverty itself because expanded food production by itself will not solve the basic problem of poverty.

Africa's food and poverty problems should not be allowed to overshadow some impressive achievements of the continent over the past twenty-five years. Foremost is the increase in average life expectancy—from an estimated thirty-eight years in 1950 to almost fifty years in 1980. This 30 percent increase is often overlooked by those who are mesmerized by rates of economic growth. Moreover, the achievements in education have been impressive in some countries, and there has been a vast improvement in the capacity of countries such as Nigeria, Kenya, the Ivory Coast, Cameroon, and Malawi to organize, plan, and manage their economies.

HISTORICAL ROOTS OF POVERTY AND THE NEGLECT OF AGRICULTURE

From this overview, one can see that while most Africans are farmers and Africa has enormous physical potential to feed itself, there are substantial barriers to tapping this potential. Experts from academia, donor organizations, and consulting firms emphasize post-independence corruption, mismanagement, repressive pricing of farm commodities, and the urban bias in development strategies. Year after year, African heads of state point to unfavorable weather in their appeal for food aid. In fact, the food production crisis stems from a seamless web of political, technical, and structural constraints which are a product of colonial surplus extraction strategies, misguided development plans and priorities of African states since independence, and faulty advice from many expatriate planning advisers. These complex, deep-rooted constraints can only be understood in historical perspective starting with the precolonial and colonial periods (Eicher and Baker 1982).

The colonial period formally began when the colonial powers met at the Berlin Congress in 1884 and decided how Africa should be partitioned among the main European powers. Until the past decade, much of the literature by economists on the colonial period has been pro-colonial. For example, Bauer boldly asserts that "far from the West having caused the poverty in the Third World, contact with the West has been the principal agent of material progress there" (Bauer 1981, 70). But empirical research over the past two decades has shown that colonial approaches to development created a dual structure of land ownership in some countries and facilitated the production and extraction of surpluses—copper, gold, cocoa, coffee, and so on—for external markets while paying little attention to investments in human capital, research on food crops, and strengthening of internal market linkages. For example, colonial governments gave little attention to the training of agricultural scientists and managers. By the time of independence in the early 1960s, there was only one faculty of agriculture in French-speaking tropical Africa. Between 1952 and 1963, only 4 university graduates in agriculture were trained in Francophone Africa, and 150 in English-speaking Africa (McKelvey 1965). In 1964, 3 African scientists were working in research stations in Kenya, Uganda, and Tanzania (Johnston 1964).

Many colonial regimes focused their research and development programs on export crops and the needs of commercial farmers and managers of plantations. In fact, Evenson (1981) points out that in 1971 cotton was the only crop that enjoyed as much research emphasis in the Third World as in industrial countries.[11] The modest investment in research on food crops could be defended during the colonial period because the rate of population growth was low—1 percent to 2 percent per annum—and surplus land could be "automatically" brought under cultivation by smallholders. But with annual rates of population growth now approaching 3–4 percent in some countries, researchers must devote more attention to food crops and the needs of smallholders and herders. Although the debate on colonialism will continue for decades, we have established the simple but important point that contemporary agricultural problems can only be understood by serious analysis of colonial policies and strategies.

FIVE DEBATES ON FOOD AND AGRICULTURE IN THE POST-INDEPENDENCE PERIOD

Africa's food and poverty problems are also a product of misguided policies, strategies, and priorities over the past two decades. In the post-independence period since 1960, African states have engaged in five key debates on food and agriculture. The first was over the priority to be given to industry and agriculture in development plans and budget allocations. As African nations became independent in the late 1950s and early 1960s, most of them pursued mixed economies with a heavy emphasis on foreign aid, industrial development, education, and economic diversification. For example, the late President Kenyatta promoted capitalism and encouraged investors "to bring prosperity" to Kenya. A small number of countries such as Mali, Ghana, and Guinea shifted abruptly to revolutionary socialism in the early 1960s. But whether political leaders were espousing capitalism or socialism, they generally gave low priority to agriculture. African leaders, like former colonial rulers, thought agricultural development would simply reinforce dependency. They tended to view agriculture as a backward sector that could provide surpluses—in the form of taxes and labor—to finance industrial and urban development. Agricultural policies in many capitalist and socialist countries supported plantations, state farms, land settlement schemes, and the replacement of private traders and moneylenders with government trading corporations, grain boards, and credit agencies. The effects of these policies on agricultural production were typically inhibiting, in some cases highly so.

The second debate was over the relevance of Western neoclassical models versus the "political economy" (stressing dependency and class structure) and radical models of development. As Western economists assumed important roles in helping to prepare development plans and served as policy advisers in the early 1960s, Western modernization and macroeconomic models were introduced into Africa. The dominant neoclassical models emphasized the industrial sector as the driving force of development and the need to transfer rural people to the industrial sector. These models had three major shortcomings. First, they assumed that one discipline—economics—could provide answers on how to slay the dragons of poverty, inequality, and malnutrition. As Hirschman (1981) reminds us, development is a historical, social, political, technical, and organizational process which cannot be understood by means of a single discipline. Second, the cities were unable to provide jobs for the rural exodus because of trade union pressure that elevated minimum wages in government and in industry and capital-intensive techniques in the industrial sector (Byerlee et al. 1983). Third, the neoclassical growth models were unable to provide a convincing micro understanding of the complexity of the agricultural sector—the sector that employs 50–95 percent of the labor force in African states. Although these models were technically elegant, they seem remarkably naive today because they assigned a passive role to the agricultural sector.

The vacuity of the Western neoclassical models of development and their failure to come to grips with the broad social, political, and structural issues, as well as the complexities of the agricultural sector, opened the door for the political economy and dependency models to emerge in the 1960s and gain a large following among African intellectuals.[12] The models that emerged in Africa were greatly influenced by Latin American dependency writers. Samir Amin, an Egyptian economist, has been the preeminent proponent of the dependency and underdevelopment paradigm of development in Africa over the past two decades.[13] The political economy literature attempts to link rural poverty and underdevelopment to historical forces, world capitalism, and surplus extraction. The political economy models have made a valuable contribution in stressing the need to understand development as a long-term historical process, the need to consider the linkages between national economies and the world economic system, and the importance of structural barriers (for example, land tenure in Zimbabwe and Zambia) to development. But there is little empirical support for many of the assertions made by some of the political economy scholars.

The question remains, Can political economy and dependency scholars move beyond their abstract models to develop models based on studies of the behavior of African farmers and herders, on African institutions, and on micro/macro linkages in order to provide policy guidance in a continent in which the majority of the people are farmers?

The third debate—over agrarian capitalism versus socialism—has been one of the most emotional topics over the past thirty years; it will continue to dominate discussions on politics, development strategies, and foreign aid in the 1980s. Even though it is difficult to define African socialism, about one-fourth of the states now espouse socialism as their official ideology. The experiences of Ghana and Tanzania are well documented. Four years after Ghana became independent, President Nkrumah abruptly shifted from capitalism to a socialist strategy that equated modernization with industrialization and large-scale farming and state control over agricultural marketing. Ghana was unable to assemble the technical and managerial skills and incentive structure to operate its vast system of state farms, parastatals, and trading corporations. The failure of agrarian socialism has imposed a heavy toll on the people of Ghana (Nweke 1978; and Killick 1978).

Tanzania's shift to socialism in 1967 produced a voluminous literature, international press coverage, massive financial support from international donors—especially Scandinavian countries and the World Bank—and attention from political leaders and intellectuals throughout Africa.[14] The vision of agrarian socialism is set forth in President Nyerere's essay "Socialism and Rural Development." But after seventeen years of experimentation, it seems fair to examine the balance sheet on socialism in a country where 80 percent of the population live in rural areas. The Tanzanian experiment is floundering in part because of the quantum jump in oil prices in the mid 1970s and the conflict in Uganda but basically because of the sharp decline of peasant crop production[15] and production on government-managed coffee, tea, and sisal estates. One cannot overlook Tanzania's gains in literacy and social services, but one may legitimately worry about their sustainability over the longer term without increased rural incomes or exceptionally heavy foreign aid flows. There are many unanswered questions about Tanzania's experiment with agrarian socialism, such as why President Nyerere authorized the use of coercion to round up farmers living in scattered farmsteads and forced them to live in villages. Many pro-Tanzania scholars avoid this topic. But the failure of Tanzania to feed its people explains why Tanzania is no longer taken seriously as a model which other African countries want to emulate.[16]

Agrarian socialism is now under fire throughout Africa: after twenty years of experimentation, presently no African models are performing well. Even Benin, Mozambique, and Guinea are silently retreating from some of the rigid orthodoxy of socialism. What are the reasons for the failure of agrarian socialism to date? First, and most important, socialist agricultural production requires a vast amount of information and managerial and administrative skills in order to cope with the vagaries of weather, seasonal labor bottlenecks, and the need for on-the-spot decision-making authority. In most African countries, the critical shortage of skills and information is the biggest enemy of agrarian socialism. No amount of socialist ideology can substitute for the lack of soil scientists, managers, bookkeepers, mechanics, and an efficient communication system. Second, many parastatals, state farms, and government-operated grain boards have been plagued with overstaffing, corruption, mismanagement, and high operating costs. Because these constraints cannot be easily overcome, it is unlikely that Africa will make much progress with socialist agriculture in this century.

As the pendulum swings from socialism to private farming and private traders in the 1980s, it is important to stress that to put all or most of the weight on ideology—capitalism or socialism—is to ignore an important lesson learned over the past thirty years in the Third World, namely, that ideology is but one variable influencing the outcome of agricultural development projects. The "correct" choice of ideology cannot in and of itself assure successful development. Examples of failure under both capitalist and socialist models are too numerous to conclude otherwise.

The fourth debate was over the use of pricing and taxation policies to achieve agricultural and food policy objectives. The first issue here is whether Africans are responsive to economic incentives. Empirical research has produced a consensus that African farmers do respond to economic incentives as do farmers in high-income countries but that Africans give priority to producing enough food for their families for the coming one to two years (Helleiner 1975). The next question is whether African states have pursued positive or negative pricing and taxation policies for agriculture.[17] Numerous empirical studies across the continent have provided conclusive evidence that many countries (both capitalist and socialist) are maintaining low official prices for food and livestock in order to placate urban consumers. The impact of these negative policies dampens incentives to produce food and livestock for domestic markets and encourages black market operations and smuggling across borders.

For example, starting in the mid 1960s Tanzania paid farmers throughout the country a uniform price for maize in order to achieve equity objectives. But this policy discouraged regional specialization, increased transportation costs, and encouraged smuggling across borders. In Mali, the government pricing policy for small farmers in a large irrigated rice production scheme in 1979/80 could be labeled "extortion." A meticulous two-year study has shown that it cost farmers 83 Malian francs to produce a kilo of rice but that the government paid farmers only 60 Malian francs per kilo (Kamuanga 1982). Does it seem irrational that farmers smuggled rice across the border into Senegal, Niger, and Upper Volta, where they secured 108–28 Malian francs per kilo?

Not only food crops are subjected to negative pricing policies; export crops are also heavily taxed. In an analysis of pricing and taxation policies for major crops in thirteen countries over the 1971–80 period, the World Bank concluded that, taking the net tax burden and the effect of overvalued currency into account, producers in the thirteen countries received less than half of the real value of their export crops (World Bank 1981, 55). These examples and other studies carried out over the past two decades provide solid evidence that African states are using negative pricing and taxation policies to pump the economic surplus out of agriculture.[18] A simple but powerful conclusion emerges from this experience: African states should overhaul the incentive structure for farmers and livestock owners and adopt increased farm income as an important goal of social policy in the 1980s. Moreover, increasing incentives to farmers and herders is a strategic policy lever for attacking poverty and promoting rural employment.

The fifth debate—about the green revolution and the African farmer—concerns what can be done to increase the low cereal yields in Africa. A dominant cause of rural poverty is the fact that 60–80 percent of the agricultural labor force is producing staple foods at very low levels of productivity. While foodgrain yields in Latin America and Asia have increased since 1965, those of Africa have remained stagnant. Over the past twenty years, the green revolution debate has focused on whether African states could import high-yielding foodgrain varieties directly from International Agricultural Research Centers in Mexico, the Philippines, and other parts of the world or whether improved cereal varieties could be more efficiently developed through investments in regional and national research programs in Africa.

Twenty years ago, foreign advisers were optimistic about transferring green revolution technology to Africa, but after two decades of experimentation the results are disappointing. In fact, the green revolution has barely touched Africa. For example, ICRISAT's transfer of hybrid sorghum varieties from India in the late 1970s to Upper Volta, Niger, and Mali was unsuccessful because of unforeseen problems with disease, variability of rainfall, and poor soils.[19] Moreover, the green revolution crops—wheat and rice—that produced 40–50 percent increases in yields in Asia are not staple foods in most of Africa.[20] Knowledgeable observers agree that African farming systems are extremely complex and that the development of suitable technical packages requires location-specific research by multidisciplinary research teams supported by strong national research programs on the staple foods of each country (Norman 1980).

These five debates illustrate the complex set of problems that have preoccupied African states over the past two decades as they have tried to find a meaningful role for their agricultural sector in national development strategies. Throughout much of the post-independence period, most states have viewed agriculture as a backward and low-priority sector, have perpetuated colonial policies of pumping the economic surplus out of agriculture, and have failed to give priority to achieving a reliable food surplus (food security) as a prerequisite for achieving social and economic goals. The failure of most African states to develop an effective set of agricultural policies to deal with the technical, structural, institutional, and human resource constraints is at the heart of the present food crisis. Part of the failure must be attributed to the colonial legacy and part to the hundreds of foreign economic advisers who have imported inappropriate models and theories of development from the United States, Europe, Asia, and Latin America. In the final analysis, agricultural stagnation in capitalist Zaire and Senegal, socialist Tanzania and Guinea, and many other countries must also be placed before heads of state and planners who have promoted premature industrialization, built government hotels, airlines, and large dams with negative internal rates of return,[21] and spent tens of millions of dollars building villas for heads of state for the annual meetings of the OAU. Moreover, most African political leaders have also exhibited a fundamental misunderstanding of the role of agriculture in national development when 60–80 percent of the people are in farming. Unfortunately, these mistakes in dealing with agriculture over the past twenty years cannot easily be overcome through crash production projects and doubling of aid over the 1980–90 period.

POLICY DIRECTION FOR THE 1980s AND 1990s

Africa's inability to feed itself amid vast amounts of unused land and record levels of foreign aid is, on the surface, one of the major paradoxes in Third World development. What should be done? While the several notable recent reports on Africa's food and economic problems agree on the severity of the food and hunger crisis, each of these assessments underemphasizes the mistakes of African states and in a somewhat self-serving fashion overstresses the need for more foreign aid. Almost all of the reports implicitly assume that capital, rather than human resources, is the most pressing constraint in rural Africa. This preoccupation with capital is understandable because foreign aid institutions such as the International Fund for Agricultural Development (IFAD) and the World Bank have a fixation on capital transfers. Moreover, Third World countries have focused on capital transfers and the need to increase aid in the north/south dialogues, and many donors and African heads of state equate a doubling of aid with an attack on poverty in Africa. The *Lagos Plan of Action,* which was adopted by the heads of state and government in Lagos in April 1980, has little new to say about agricultural development except that food production should be accelerated with the aim of achieving self-sufficiency (OAU 1980). The World Bank's report *Accelerated Development in Sub-Saharan Africa* (1981) correctly singles out domestic policy issues as the heart of the crisis, but it also advances an unsupported appeal for donors to double aid to Africa over the 1980–90 period. Further, while the World Bank report criticizes large-scale irrigation projects, it does not report the Bank's own difficulties (and those of most of the other donors) in designing sound livestock projects. The World Food Council's (1982a) report on the African food problem correctly notes the overemphasis on project-type aid, the excessive number of foreign missions (for example, Upper Volta received 340 official donor missions in 1981), and the small percentage of aid funds for food production projects, but it skirts many of the political and structural barriers to change. The World Food Council's (1982b) report by the African ministers of agriculture avoids the topic of population growth, the empirical record of agrarian socialism, and the disastrous performance of state grain boards. New approaches are needed. The following discussion spells out a comprehensive approach for the 1980s and 1990s.

STEPS TO MEET THE CRISIS

Solutions to Africa's food and poverty problems must, first of all, be long-term. Second, they require a redirection in thinking about agriculture's role in development at this stage of Africa's economic history and about the need for a reliable food surplus as a precondition for national development. Third, there is a need for both African states and donors to admit that the present crisis is not caused by a lack of foreign aid. In fact, in many countries current aid flows cannot be absorbed with integrity. Hence, donors are part of both the problem and the solution. The Berg report underplays these issues in its unsupported case for doubling aid to Africa by the end of the 1980s (World Bank 1981). Fourth, there is a need to recognize that the lack of human resources is an overriding constraint on rural change in Africa. In fact, the human resource constraint severely limits the amount of aid that can be effectively absorbed in the short run. In order to buy time to lay a foundation for long-range solutions, it will be necessary to rely on a number of holding actions. Examples include expanded commercial food imports, food aid, and promoting seasonal and international migration until more land is brought under irrigation and higher rainfall areas can be cleared of tsetse flies and river blindness. But these holding actions must not be allowed to substitute for efforts towards long-range solutions.

Three steps should be taken now to start the process of formulating longer-term approaches. First, African states, donors, and economic advisers should jettison the ambiguous slogans such as "National Food Self-Sufficiency," "Food First," and "Basic Needs."[22] Although these have a powerful emotional and political appeal, they offer little help in answering the key question: What blend of food production, food imports, and export crops should be pursued to achieve both growth and equity objectives? The concept of national food self-sufficiency should be scrapped as a rigid target because it promotes autarchy and ignores the historical and the potential role of trade in food and livestock products between African states. In summary, there is a need to return to the basics of agricultural development: investments in human resources and agricultural research, policy and structural reforms that will help small farmers and herders, revamping the incentive structure, changing the role of the state,[23] and strengthening the administrative capacity to design and implement projects and programs.

The second immediate step should be the phasing out or restructuring of some of the crash food production projects—that is, seed multiplication, irrigated wheat schemes, livestock schemes, and integrated rural development projects—that are floundering. Many of these crash projects were hastily assembled over the past decade without a sound technical package and without being tested in a pilot phase. These unproductive projects consume scarce high-level manpower, perpetuate recurrent cost problems, and create a credibility problem for both African policy makers and international donors. Particularly important is the reassessment of integrated rural development (IRD) projects. The weakness of most IRD projects—their lack of emphasis on food production and income-generating activities—can be corrected by restructuring some of the projects rather than phasing them out. Other projects that have been implemented in advance of a sound knowledge base, like those in livestock, should be either phased out or scaled down and continued as pilot projects for a five-to-ten-year period. A five-to-ten-year pilot phase is unheard of in Africa, but in projects like those in livestock it is a necessary period for solving technical problems and developing appropriate local institutions to solve such key issues as overstocking.

The third immediate step is to scale down the state bureaucracy, the state payroll, and state control over private farmers and private traders. After twenty years of experience with parastatals, the record is clear: parastatals (public enterprises) are ineffective in producing food, are no more efficient than private traders in foodgrain marketing, are almost all overstaffed,[24] and serve as a sponge for foreign aid. As the number of parastatal employees increases, the pressure intensifies for donors commensurately to increase their contributions to meet the payroll of the expanded bureaucracy. The parastatal disease is well known, but it is not given much attention in the reports cited above, except in the World Bank's *Accelerated Development* report, which should be applauded for its candor on this topic.

The fourth step is to realize that a food policy strategy cannot be pursued in isolation from livestock and export crop policies nor in isolation from policies to deal with rural poverty. A food policy strategy should not rule out the expansion of export crops, because expanded farm income, through food sales, export crops, and off-farm income, and productive rural employment are prerequisites for solving rural poverty problems. Moreover, although food aid can help the rural poor in the short run, the expansion of productive rural employment is fundamental to coping with rural poverty in the long run.

FOOD POLICY STRATEGIES

The starting point for food policy analysis in each country should be the development of a food policy strategy with two goals in mind: achieving a reliable food surplus (based on domestic production, grain storage, and international trade) and reducing rural poverty by focusing on measures to help small farmers produce more food for home consumption and more food, cash crops, and livestock for the market so that they can purchase a better diet.[25] But a word of caution is in order: food policy analysis is every bit as complex and as delicate as family planning.[26] The rice riots in Monrovia, which left more than one hundred dead in 1979, and the sugar riots in Khartoum and other major cities in the Sudan following the doubling of sugar prices in 1981 are reminders of the narrow range of options for policy makers on food policy issues. Consequently, as experiences from the Sudan, Zimbabwe, Nigeria, and Kenya (outlined below) illustrate, most countries will move very slowly on policy reforms unless spurred by famine, a reduction in foreign-exchange earnings from petroleum, or coordinated donor leverage to link long-term food aid with policy reforms.

The Sudan provides a conspicuous example of the difficulty of mobilizing the agricultural sector as an engine of growth and expanded food production. In the mid 1970s the international press frequently asserted that the Sudan could become the "breadbasket of the Middle East" by drawing on several billion dollars of OPEC loans and gifts to develop its vast reserve of idle land. The issue today, however, is not one of exporting food to the Middle East but one of the Sudan's inability to feed its 18 million people. The Sudan was forced to rely heavily on food aid in the early 1980s in order to cope with severe balance-of-payment problems and inflation. Although the Sudan has historically excelled in cotton research, it has devoted only token attention to research on food crops. As long as the Sudan continues to receive food aid and has hopes of striking oil in the southern part of the country, there is little likelihood of policy reforms.

In Zimbabwe, the legacy of the colonial policy of promoting a dual structure of large farms for white farmers and small farms for Africans in poor natural resource regions presents a classic efficiency/equity dilemma for the Mugabe government (Zimbabwe 1981). In the early 1980s Zimbabwe was a significant maize exporter based largely on the surpluses produced by its thirty-five hundred large farmers. But the maize exports were heavily subsidized, and in 1982 the government reconsidered its role as a food security safety net for the southern African region. In 1982 Zimbabwe increased price incentives for soybean oil relative to maize in order to meet the domestic shortage of cooking oil. Although Zimbabwe gains political prestige by exporting maize to black Africa, it realizes that it cannot continue to subsidize maize exports at a time when it is facing large budget deficits.

On the eve of independence in 1960, Nigeria was a net exporter of food, mainly oil palm and groundnuts. But during the 1960s Nigeria pursued import-substituting industrialization, taxed its farmers heavily through export marketing boards, experimented with land settlements, and promoted government plantations. In 1970, ten years after independence, Nigeria was importing food, and by 1981 food imports from the United States alone totaled more than $1 billion. Petroleum exports have enabled Nigeria to pay for food imports and buy time. Although Nigeria is far ahead of most Francophone African countries in trained agricultural manpower, Idachaba (1980) reported that more than 40 percent of the positions for senior agricultural researchers in the eight major research stations were vacant in 1978. The government recently concluded that it will take ten to fifteen years to achieve self-sufficiency in food production. Nigeria has now formed a high-level Green Revolution Committee to address its food problem (Abalu 1982).

Although Kenya is widely regarded as an agricultural success story of the 1960s and 1970s, Kenya was confronted with food shortages in 1980 and 1981 and was forced to import maize, wheat, and milk powder. Although adverse growing conditions contributed to the food shortages of the early 1980s, the National Food Policy paper (Kenya 1981) reveals that other factors were undermining Kenya's capacity to feed itself. These included the unprecedented 4 percent rate of growth of population, the decline in wheat production following the transfer of large farms to smallholders, and a smallholder credit repayment rate of 20 percent. The message of the National Food Policy paper is clear: Kenya has a major food production constraint that cannot be overcome except through large investments in agricultural research, irrigation, and land reclamation in the 1980s and 1990s. But one wonders why the National Food Policy paper paid lip service to population growth.

These case studies illustrate the complexity of Africa's food problems and the need to analyze each country's problems on a case-by-case basis. Moreover, food policy analysis requires more than the preparation of a National Food Policy strategy paper over a two-to-six-month period. Food policy analysis is an ongoing process that will undoubtedly occupy the attention of policy makers and researchers throughout the 1980s and 1990s.

FOOD AID LEVERAGE

A major issue in achieving policy reforms is whether donor agencies and countries can or should use food aid leverage to promote the required changes. In existence for almost thirty years, food aid is now a topic of growing interest in Africa. Although there is unanimity on using food aid for humanitarian purposes—for example, feeding refugees—food aid for development is more controversial. The opposition to this sort of food aid—where food is sold at concessional terms and extended as grants for food-for-work programs—comes from evidence that food aid (1) can reduce the pressure on recipient countries to carry out policy reforms; (2) can depress farm prices; (3) is unreliable;[27] and (4) can promote an undesirable shift in consumption patterns that will increase rather than reduce dependency or require subsidies (such as wheat production in West Africa) to maintain the Western-acquired consumption pattern.[28]

Food aid programs are firmly institutionalized with donors. Food aid accounted for approximately 40 percent of all U.S. economic assistance to Africa over the 1970–80 period. Even Japan started to dispose of some of its surplus rice in Africa in the early 1980s. To date, there has been little solid academic research on the role of food aid for development purposes in Africa. Moreover, the evaluation of food aid is usually assigned to junior officers in many bilateral agencies. Hence, evaluation studies of food aid by donors should be taken with a grain of salt. The food aid experience in Asia and Latin America, however, shows that the availability of food aid can take the pressure off recipient nations to carry out internal policy reforms.

A compelling case can be made for linking food aid with policy reforms in major food-deficit countries in Africa through the development of food policy reform packages. These reform packages will be useless, however, unless there is an agreement by donors to make three- to five-year forward food aid commitments in exchange for internal policy reforms. Countries such as Mali and the Sudan would be good test cases for linking food aid to tough domestic policy reforms. But unless donors agree to meet minimum forward food aid levels, African states can easily postpone policy reforms and continue to rely on a patchwork of bilateral food aid programs.

AGRICULTURAL RESEARCH

Beyond policy reforms, a long-range solution to food and hunger problems will depend, to a large degree, on achievements in agricultural research. Authorities on food production and livestock projects in the field now commonly bemoan the lack of proven technical packages for small farmers in dry-land farming systems throughout Africa and the uniformly unfavorable technical conditions (low rates of growth, disease) for livestock production. Significant increases are needed over the next twenty years in research expenditures on dry-land farming systems with emphasis on food crops (white maize, yams, cassava, millet, and sorghum) and on livestock.

An expanded research program on food and livestock should be viewed in a twenty-year time frame because problems such as low soil fertility and livestock diseases cannot be resolved through a series of short-term, ad hoc research projects. The U.S. experience, wherein forty years (1880–1920) were spent developing a productive system of federal and state research programs, should be heeded by donors who are likely to expect major results in three to five years from new research projects in Africa.

Research on irrigation is particularly important and should be accelerated in the coming decades. The knowledge base for irrigation in Africa is meager. Irrigation has played a minor role in Africa except in large-scale projects in the Sudan and in Madagascar, where there is a history of irrigation by small farmers. The cultivated land under irrigation is probably less than 5 percent in most other countries (as compared with an estimated 30 percent in India). Following the 1968–74 drought in the Sahel, there was considerable optimism about the role of irrigated farming in "drought-proofing" the region. Due to numerous technical and administrative problems and human resource constraints, however, the projected expansion of irrigation in the Sahel is behind schedule, and it is certain that irrigation will not play a significant role in the Sahelian states until early in the next century.

Although research on the economics of irrigation is fragmentary, the limited results provide support for a smallholder irrigation strategy in the 1980s, with priority given to ground-water development with small pumps, land reclamation through drainage and water control, and an increase in small-scale projects that are developed and maintained by groups of farmers with their own family labor. A small-scale irrigation strategy is advocated because the cost of bringing more rainfed land under cultivation is substantially less than the cost of leveling and preparing land for large-scale irrigation. For example, recent irrigation projects in Niger, Mauritania, and northern Nigeria each had costs of more than ten thousand dollars per hectare at 1980 prices (World Bank 1981, 79). On the other hand, farmers in Senegal have cleared and prepared their own land for irrigation, expending several hundred hours of family labor per hectare. Although irrigation will not be a panacea for the recovery of the Sahel nor for feeding Africa in the 1980s and 1990s, a long-term research program on the human, technical, and institutional dimensions of irrigation should be initiated in the immediate future.

It remains to be seen whether donors will have the courage to view research and graduate training within Africa as a long-term investment and whether they will provide guaranteed funding for a minimum of ten years. Another important issue is whether country priorities of bilateral donors will remain stable enough to assure African countries of continuity in funding over a ten-year period. A rule of thumb is that an African country should never embark on a long-term program to upgrade its national agricultural research system with major support from only one bilateral donor. But as we point out below, co-financing by six to eight donors can create as many problems as it solves.

INVESTMENT IN HUMAN RESOURCES

A third essential component of a long-range strategy is massive investments in human capital formation, including graduate training of several thousand agricultural scientists and managers. This is necessary to replace the foreign advisers, researchers, managers, and teachers in African universities and to meet the needs of a science-based agriculture in the next century. Since it takes ten to fifteen years of training and experience beyond high school to develop a research scientist, the investments in human capital will not produce payoffs for Africa until the 1990s.

Building graduate agricultural training programs within Africa necessitates a reexamination of the role of the African university in national development and the relevance of some of the present undergraduate degree programs. For example, in 1982 the Faculty of Law and Economics in the University of Yaoundé in Cameroon was turning out graduates with degrees in law and economics who ended up on the unemployment lines in Yaoundé. The time is propitious for African universities to move from undergraduate to graduate training programs in science and agriculture. Before graduate education is expanded, however, some questions should be raised about priorities in undergraduate education and the relevance of the curriculum. Undergraduate degree programs in agriculture in many universities are still embarrassingly undervalued and underfunded when compared with programs in law, medicine, and history. For example, the University of Dakar in Senegal was formally established in 1957, and in 1960 the Senegalese assumed its administration. In 1982 there were approximately twelve thousand students in the University of Dakar, of whom several thousand specialized in law and economics. Not until 1979 was a National School of Agriculture established at Thies, near Dakar, to offer undergraduate training in agriculture. That university-level teaching of agriculture was not initiated until nineteen years after Senegal's independence reflects an enduring colonial legacy as well as the government's ambivalence about agriculture's role in national development.

Although the structural reforms entailed in redesigning African universities to serve rural Africa will require decades to resolve, it is time for donors to stop merely paying lip service to African universities. Whereas donors embraced African universities in the 1960s, they generally withdrew their support in the 1970s as they promoted crash food production and IRD projects and invested heavily in international agricultural research centers. Money saved ($100 million to $200 million) from phasing out the floundering crash projects cited above can be reallocated to selected African universities with emphasis on faculties of agriculture. Donors should press for long-term structural reform of the curriculum in universities in exchange for long-term aid commitments of ten to twenty years.

In 1982 graduate-level education for African students in the United States cost $1,850 per month, or $39,000–$55,000 for a Master's degree over a twenty- to thirty-month period. Donors should gradually phase out Master's-level training programs in agriculture and related fields in the United States. Instead, U.S. faculty members should be sent to Africa to help develop regional centers of excellence in graduate training in eight to ten African universities over the next ten to fifteen years. In order to achieve this goal, donors will have to give greatly increased priority to aiding African universities, including ten-year authorizations to foreign universities to provide teachers for graduate instruction and research. In the final analysis, the initiative for this second phase—graduate training in agriculture in African universities—will have to come from within Africa.

DEALING WITH RURAL POVERTY

The fourth component of a long-range solution to Africa's food crisis will be an ongoing effort to address the hunger/malnutrition/poverty problem. Rural poverty is potentially a much more difficult problem to solve than the food production gap, but self-sufficiency in food production will be a bogus achievement if the poor do not have access to a decent diet. A society cannot expect to move from a low- to a middle-income stage of development if two-thirds of its population are producing millet, sorghum, maize, and yams at stagnant levels of output. Agricultural research on foodgrain production is a prerequisite to increasing food production. Moreover, since jobs cannot be created in urban areas for all the unemployed, a rural investment strategy should also facilitate the expansion of rural small-scale industries that are labor-intensive and can provide jobs.[29]

IMPLICATIONS FOR FOREIGN AID

The implications of all this for the foreign assistance community flow quite clearly from the foregoing analysis. Currently, forty donors are moving funds and technical assistance through a patchwork of several thousand uncoordinated projects in support of agricultural and rural development throughout Africa. In turn, African states are allocating a high percentage of a scarce resource—trained agricultural professionals—to meet the project reporting requirements of donors, and African governments are asking donors to pay the recurrent costs—salaries, petrol—of the aid-funded projects. In short, both donors and recipients are prisoners of projects and slogans, and they are caught in a vicious circle. Should aid to Africa be doubled in real terms during this decade? The answer depends on whether donors and African states can replace the short-term approaches with long-term investments and address the following in a consistent manner:

1. *Food security policies and strategies.* Donors should urge African policy makers to focus on policies and strategies to achieve a reliable food surplus (food security) based on local production, storage, and international trade. Despite the pleas of international journalists who urge donors to increase the number of food production projects, a single food policy reform in Mali—raising official farm prices—may be more effective than twenty new food production projects. Donors should concentrate their resources on helping local professionals develop an improved micro foundation for food policy analysis that addresses the constraints on achieving a reliable

food surplus, with emphasis on food production, storage, and international trade.

2. *Long-term investments.* Emphasis should be placed on reducing the number of tiny projects (such as producing visual aids for the livestock service in a Sahelian country), increasing the lifetime of aid projects, and increasing the volume of aid in program grants that are tied to policy reforms. Long-term investment programs like ten-year research projects, five-to-ten-year pilot livestock projects, twenty-year programs to develop colleges of agriculture, and five-year food aid/policy reform packages should be perceived not as luxuries but rather as prerequisites to solving Africa's technical, structural, and human capital constraints.
3. *Technology generation within Africa.* Professional agriculturalists in most donor agencies privately concede that there is currently an excess of donor funds in search of agricultural production projects supported by agricultural research findings that have been tested and proven on farmers' fields. In short, the international technology transfer model has failed in the direct transfer of foodgrain varieties from Mexico or India to Ghana, Lesotho, and Upper Volta. What can be done? In my judgment, donors should (*a*) admit that the international technology transfer model is not producing the expected results, (*b*) maintain but not increase investments (in real terms) in the four International Agricultural Research Centers (IARCs) in Africa, and (*c*) increase the level of financial assistance to national agricultural research systems and to faculties of agriculture in African universities.

   Although the U.S., Mexican, and Indian foodgrain varieties are not directly transferable to Africa, some of the processes these countries used to generate technology appropriate to the needs of their farmers in dry-land areas are applicable in helping to strengthen faculties of agriculture in African universities and national agricultural research services. For example, the U.S. dust bowl crisis in Kansas and Oklahoma in the 1930s gave rise to the U.S. Soil Conservation Service, research on new varieties, irrigation, and other techniques which transformed the dust bowl into a highly productive area of American agriculture over a thirty-year period. In this process, U.S. colleges of agriculture played a strategic role, in cooperation with local and state organizations and with the U.S. Department of Agriculture.
4. *Co-financing.* Co-financing of aid projects by donors is a growing problem in Africa because typically six to eight donors each underwrite a piece of an agricultural project. Co-financing is attractive because it spreads the risk for donors and reduces the dependency of African states on one donor. But co-financing is proving to be a liability for institution-building projects such as research institutes and extension schools. The recipient institutions are caught in a cross fire of imported perspectives from technical advisers, a hodgepodge of buildings, and dubious gifts of equipment from around the world. Moreover, the administrators of these local institutions are overwhelmed by the administrative and reporting requirements of the donors. At most, two donors—one for infrastructure and one for technical assistance and training—should be allowed to assist any one institution. But African states will have trouble getting weaned away from co-financing because they are using this device to pay for part of their recurrent budget deficits and the payroll of the state bureaucracy.[30]

5. *Foreign private investment.* A major topic of debate is whether foreign private investment, especially multinational firms, can contribute to the resolution of Africa's food and poverty problem. A related question is whether bilateral aid should assist foreign private firms in establishing fertilizer plants, processing plants, and in some cases large-scale food production projects. Just as the roles of women in African development cannot be analyzed in isolation from those of men, the role of the private sector can only be analyzed in relation to public investments. The poor record of food and livestock production projects throughout Africa over the past ten years provides ample proof that many of these projects fail because public-sector investments were not made in agricultural research to develop profitable packages for rainfed farming, prevention and control of animal disease, rural roads, and schools to train agricultural managers. Public-sector investments can either facilitate or destroy the conditions for capitalists to function in a market-oriented economy.

   In general, inadequate infrastructure, local managerial skills, and technical constraints severely limit the scope for foreign private investment in food production projects and in agroindustries in Africa. Although some foreign firms prospered in colonial periods, when they were given choice land and protected markets, since independence there have been many failures, including the recent efforts of U.S. firms to produce food in Ghana, Liberia, and Senegal. As a rule of thumb, if foreign private firms engaged in food production projects do not receive special subsidies, they cannot compete with African smallholders who have a knowledge of local climate, pests, and soils and are willing to produce food on their own land at rates of return of seventy-five cents to three dollars per day for family labor. Moreover, the large capital-intensive plantations and ranches emphasized by foreign private firms should be questioned on social grounds because they do not produce the badly needed jobs in an area of the world where seasonal unemployment is widespread. Foreign private enterprise, however, can contribute to Africa's food system in countries such as Cameroon, Kenya, the Ivory Coast, and Zimbabwe, which have a good infrastructure and need international managerial skills and capital for investments in food processing plants and in fertilizer and agricultural input industries. But in the final analysis, the focus of foreign aid should be on making public investments in roads, universities, and research stations to help African capitalists—small farmers and herders—produce food for their families and for urban and rural people.

Aid flows to Africa have grown dramatically in recent years: net official aid in 1980 was $13.70 per capita in Africa, compared with an average of $9.60 for all developing countries. In the Sahelian region of West Africa per capita aid was running from $35 to $50 per person in 1982. In many circles in Africa there is a feeling that the continent is already too heavily dependent on aid and foreign transactions relative to the scarcity of African professionals to implement the projects. In fact, in many countries the critical constraint is not land or capital but human resources. This simple fact is overlooked by many donors—including the World Bank. The World Bank, under Robert McNamara, dramatically increased lending in the 1970s, and it has appealed to donors to double lending to Africa in the 1980s. The unsupported case for doubling aid to Africa in the 1980s, in the light of the acute lack of human resources, is, in my judgment, a major flaw in the Berg report (World Bank 1981). If, however, donors take a broad view of the need for massive, long-term public investments in agricultural research, roads, faculties of agriculture in African universities, and land transfer funds (for example, for Zimbabwe) and if African countries change their agricultural development strategies and priorities and introduce policy reforms, then it may be desirable for donors to double aid to Africa in real terms over the 1980–90 period.

SUMMARY

To sum up, agricultural development is a slow and evolutionary process, and it is up to African states and donor agencies to jettison the crash project approach and start now to lay the foundation for long-term investments to solve the food production and poverty problems over a ten-to-twenty-year period. Unless steps are taken in the 1980s to overcome these basic technical, political, structural, and policy constraints, many African states may end up in the 1990s as permanent food-aid clients of the United States, the European Economic Community, and Japan.

NOTES

1. Africa is defined here to include all states in sub-Saharan Africa except the Republic of South Africa.

2. Low and unstable rainfall is a common problem in the Sahelian region of West Africa, parts of the Sudan, Ethiopia, Somalia, Kenya, Tanzania, Zimbabwe, and Botswana. But erratic rainfall, like any other single factor, cannot explain the steady erosion in Africa's capacity to feed itself.

3. Per capita GDP ranges from $120 in Chad to $1,150 in the Ivory Coast. Although per capita income is an imperfect measure that is not well suited to international comparisons, there is no question that rural poverty is a major problem throughout Africa. But because of access to land and the absence of a landless labor class, one does not witness in Africa the grinding poverty that is so pervasive in Haiti, Bangladesh, and India.

4. The average aid flows in the eight Sahelian countries was about $50 per capita in 1982 (USAID 1982, 5). Kenya received $450 million of foreign assistance in 1982, or about $25 per person.

5. Commonly known as the Berg report because Elliot Berg was the study coordinator.

6. Tsetse control is a long-term and costly activity that includes clearing of vegetation that harbors flies, spraying, release of sterile male flies, and human settlement.

7. But Ethiopia was under Italian occupation from 1936 to 1941.

8. For more information see Ruthenberg 1980; and Eicher and Baker 1982.

9. The USDA figures on per capita food production trends in Africa over the past two decades (USDA 1981) should be treated as rough estimates because population and production data for two of the large countries—Nigeria and Ethiopia—are open to question. Since Nigeria and Ethiopia together have about one-third the population of Africa, data distortions in these countries could affect the overall averages for Africa.

10. See Mellor, chapter 10 in this volume.

11. See Evenson, chapter 24 in this volume.

12. For an assessment of the modernization, dependency, and political economy models see Young 1982 and Leys 1982.

13. See the discussion of Amin's work in chapter 1 of this volume.

14. Tanzania received $2.7 billion of Official Development Assistance—a record in Africa—over the ten-year period 1973–82.

15. The sharp decline in real producer prices in the 1970s was undoubtedly an important contributor to the decline in output. Ellis (1982) reports a 35 percent decline in the price- and income-terms of trade of peasant crop producers over the 1970–80 period.

16. Tanzania is slowly dismantling its state control over agriculture following the 1982 Task Force Report (Tanzania 1982) and pressure from donors. The new agricultural policy (Tanzania 1983) has reintroduced cooperatives, turned some government estates over to village cooperatives, and encouraged foreign private investment in tea and sisal production.

17. Positive and negative pricing and taxation policies are shorthand references to the internal terms of trade between agricultural and nonagricultural products. Negative pricing and taxation policies mean that the terms of trade of agriculture are deliberately depressed by government policies (see Krishna, chapter 11 in this volume).

18. The following political constraints are partially responsible for the negative policies towards export crops: need for foreign exchange, politically powerful trade unions and urban groups, the demands of the military, and the absence of alternative ways to tax agriculture when land is not registered and the government does not have enough skilled people to collect land or incomes taxes. The net result of these constraints is that African political leaders have little room to maneuver on pricing policies for export crops. Hence, the neoclassical economist who argues that "getting prices right" is the core of the development problem is overlooking the imperative of political survival in Africa.

19. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has its headquarters in Hyderabad, India. Recently, ICRISAT made a major policy decision to deemphasize the direct transfer of cereal varieties from Asia to the Sahelian countries and to construct a Sahelian research center on a five-hundred-hectare site near Niamey, Niger. The scientific staff of the Sahelian center will carry out long-term (ten-to-twenty-year) research on cereal production in the Sahel. This is further evidence that agricultural development is a slow and evolutionary process.

20. But wheat and rice consumption are increasing in urban areas throughout Africa.

21. For example, the $900 million Diama and Manantelli dams along the Senegal River are projected to have negative internal rates of return.

22. Although the World Bank was a staunch advocate of basic needs strategies in the late 1970s, it has recently abandoned its support for this dubious concept. Still the International Labour Office continues to confuse African states with recent basic needs missions to Zambia, Tanzania, and Nigeria (ILO 1981).

23. The state should play a less direct role in agricultural production and marketing and emphasize indirect approaches such as agricultural research, extension, credit, and educational programs to help small farmers and herders.

24. Although the government of Senegal dissolved its grain board—ONCAD—in 1980, a large percentage of the employees were transferred to other government agencies.

25. See Timmer, chapter 8 in this volume.

26. Food policy analysis requires a large amount of micro information on production, consumption, nutrition, and the functioning of markets, but this information is not available in most African countries. Although the World Food Council reported that nineteen African countries were preparing national food strategies in 1981, many of these exercises were prepared in capital cities in three to six months, and many of them are likely to be forgotten in three to six months.

27. For example, U.S. food aid to Mozambique was cut off for six months in 1981 (see Anderson 1981).

28. The bulk of U.S. food aid—60 percent to 70 percent—is in the form of wheat and wheat flour even though wheat is not a staple food in most of rural Africa.

29. For empirical support showing that a rural investment strategy for smallholders and small-scale industry can achieve both growth and employment objectives see the results of a nationwide survey in Sierra Leone (Byerlee et al. 1983).

30. For example, the government agency responsible for the development of the Senegal River Valley—SAED—was assisted by thirteen donors in 1982. SAED employed one thousand workers and encountered an $8.5 million recurrent budget deficit in 1982. SAED asked the thirteen donors to pay two-thirds of the cost of the deficit.

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Appendix D

List of Acronyms

AAAS — American Association for the Advancement of Science
ADF — African Development Foundation
AID — U.S. Agency for International Development
ATI — Appropriate Technology International
CDIE — Center for Development Information and Evaluation (AID)
CDSS — Country Development Strategy Statement
CGIAR — Consultative Group on International Agricultural Research
ESF — Economic Support Fund
FAO — U.N. Food and Agricultural Organization
FSR — Farming Systems Research
GAO — U.S. General Accounting Office
GDP — Gross Domestic Product
GNP — Gross National Product
ICRW — International Center for Research on Women
IITA — International Institute of Tropical Agriculture (CGIAR)
ILCA — International Livestock Center for Africa (CGIAR)
ILO — International Labor Organization
IMF — International Monetary Fund
OECD — Organization for Economic Cooperation and Development
OPIC — U.S. Overseas Private Investment Corporation
OTA — Office of Technology Assessment, U.S. Congress
P.L. 480 — Public Law 83-480 (Agricultural Trade Development and Assistance Act)
PVO — Private Voluntary Organization
TVS — Training and Visit System
U.N. — United Nations
UNCOD — U.N. Conference on Desertification
UNESCO — U.N. Education, Scientific, and Cultural Organization
UNICEF — U.N. International Children's Fund
UNIDO — U.N. Industrial Development Organization
USDA — U.S. Department of Agriculture
VITA — Volunteers in Technical Assistance
WHO — U.N. World Health Organization
WID — Women in Development Office (AID)

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Office of Technology Assessment

The Office of Technology Assessment (OTA) was created in 1972 as an analytical arm of Congress. OTA's basic function is to help legislative policymakers anticipate and plan for the consequences of technological changes and to examine the many ways, expected and unexpected, in which technology affects people's lives. The assessment of technology calls for exploration of the physical, biological, economic, social, and political impacts that can result from applications of scientific knowledge. OTA provides Congress with independent and timely information about the potential effects—both beneficial and harmful—of technological applications.

Requests for studies are made by chairmen of standing committees of the House of Representatives or Senate; by the Technology Assessment Board, the governing body of OTA; or by the Director of OTA in consultation with the Board.

The Technology Assessment Board is composed of six members of the House, six members of the Senate, and the OTA Director, who is a nonvoting member.

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OTA-BP-F-31 DECEMBER 1984